EXHIBIT 1

REDACTED

---------- Forwarded message ---------

From: **Alaina Kwasizur** [redacted]

Date: Mon, Sep 28, 2020 at 12:52 PM

Subject: Sonos Notice

To: Bradley Riel [redacted], Tim Kowalski [redacted]

Cc: <[redacted]

Dear Tim and Brad,

As you know, Sonos spent years trying patiently and in good faith to resolve Google's infringement of Sonos's intellectual property. Despite Sonos's efforts, our discussions have never meaningfully progressed. Even since we filed in the ITC, Google has increased the scope of its infringement and brought a multiplicity of retaliatory lawsuits in countries around the world. These lawsuits will not have their intended effect.

Attached please find a courtesy copy of the complaint that we will file Tuesday, September 29th in the United States District Court. In this lawsuit, Sonos will focus on Google's infringement of U.S. Patents 9,967,615;

10,779,033; 9,344,206; 10,469,966; and 9,219,460 although, as we have discussed, Google infringes many more of Sonos's patents.

We continue to be hopeful that Google will reconsider its infringement and its refusal to engage in a meaningful discussion.

Best,

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Alaina Kwasizur
Sonos, Inc. | General Counsel, AMPAC | [redacted]

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Alaina Kwasizur
Sonos, Inc. | General Counsel, AMPAC & Chief Diversity & Inclusion Officer | [redacted]

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

SONOS, INC.,	§	Case No.
	§	
Plaintiff,	§	**COMPLAINT FOR PATENT INFRINGEMENT**
	§	
v.	§	
	§	**Jury Trial Demanded**
GOOGLE LLC,	§	
	§	
Defendant.	§	
	§	
	§	

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Sonos, Inc. ("Sonos" or "Plaintiff") hereby asserts claims for infringement of United States Patent Nos. 9,967,615; 10,779,033; 9,344,206; 10,469,966; and 9,219,460 (the "patents-in-suit"; attached hereto as Exhibits 1-5 respectively) against Defendant Google LLC ("Google" or "Defendant"), and alleges as follows:

INTRODUCTION

1. Sonos is an American success story. It was founded in 2002 in Santa Barbara, California by a handful of engineers and entrepreneurs with a vision to invent the world's first wireless, whole-home audio system. At the time, popular audio systems were dependent on a centralized receiver hard-wired to each individual passive speaker throughout a home. Further, most homes with Internet access had dial-up connections, the iPhone was still five years away, and there were no streaming music services. The technological barriers confronting Sonos were enormous.

2. To deliver on its vision, the Sonos team completely reimagined the in-home music system as a decentralized network of smart playback devices, and it developed a platform that

could seamlessly and wirelessly distribute audio room by room or throughout the home at the user's discretion. Sonos created a "choose what to play, where to play it, and how loud" wireless audio system that could not only perform without lag (*e.g.* buffering, or network interruptions), but that was also so simple and intuitive that customers would make it part of their daily lives.

3. Commercial success did not come easy for Sonos as its vision was in many ways ahead of its time. But year by year, consumers – and the entire industry – came to appreciate that wireless multi-room audio devices and systems could not only work, but could become an essential part of the listening experience. Success required staying true to Sonos's disruptive vision, continuing to innovate while adjacent industries caught up and customers became more and more enamored with the idea of Sonos as they had the chance to encounter and use its products. Once Sonos had taken all the risks and placed enormous bets on research and development, the "first followers" began to copy Sonos's innovations.

4. To this day, Sonos remains focused on innovations that further enhance the listening experience. Sonos invests heavily in research and development and, as a result, frequently invents new systems with new technologies, enhanced functionality, improved sound quality, and an enriched user experience.

5. As a result, Sonos has become one of the world's leading providers of innovative audio products. In recognition of its wide-ranging innovations, the U.S. Patent & Trademark Office has granted or allowed Sonos more than 940 U.S. patents, including the patents-in-suit, with hundreds more patents in other countries. The innovations captured by these patents cover many important aspects of wireless multi-room audio devices/systems, including, for example, how to manage and control groups of playback devices, how to facilitate seamless control and transfer of audio playback among devices, and how to output amazing sound quality.

6. The industry has recognized the importance of Sonos's patents. For example, Sonos earned a spot on the IPO list of "Top 300 Organizations Granted U.S. Patents" and the

IEEE recognized Sonos as having one of "[t]he technology world's most valuable patent portfolios." *See* Exs. 6 and 7.

7. Sonos launched its first commercial products in 2005 and has since released a wide variety of critically acclaimed, patented, wireless multi-room audio products, including, for example, the Play:1, Play:3, Play:5 (Gen 1 and Gen 2), One (Gen 1 and Gen 2), One SL, Move, Playbar, Playbase, Beam, Sub, Connect, Port, Connect:Amp, Amp, Five, and Arc. *See, e.g.*, Ex. 8. Sonos's products can be set up and controlled by the Sonos app. *Id.*

8. Sonos's efforts have made it incredibly popular with its customers. Sonos estimates that in fiscal year 2019, Sonos's customers listened to 7.7 billion hours of audio content using its products. And, as of September, 2019, almost two thirds of Sonos households had purchased and installed more than one Sonos product.

9. Sonos's record of innovation has made it the undisputed leader in what has come to be called the "multiroom audio" field. *See, e.g.*, Ex. 9 (2018 Digital Trends: "Sonos is the king of multiroom audio…."); Ex. 10 (2019 What Hi-Fi: "[N]o multi-room offering is as complete or as pleasurable to live with as Sonos.").

10. Sonos has already sued Google for infringing patents on its first group of inventions involving the set-up, control, playback, and synchronization of wireless playback devices. This case involves a second group of inventions which, as described more extensively below, tackle the novel technological challenges of how to stream music from a cloud-based service, how to create, manage, and invoke "zone scenes" to configure how multiple playback devices work together, and how to dynamically adjust the equalization of a playback device based on the environment in which the playback device is operating.

GOOGLE BEGINS INFRINGING

11. Almost a decade after Sonos created the smart-speaker market, Google entered the space. Initially, Google sought to work with Sonos and, through those efforts, gained access to

Sonos's engineers, products, and technology. All too quickly, however, Google shifted focus and began to develop and sell products that copied Sonos's technology and infringed Sonos's patents.

12. Part of what makes Sonos so successful is that, through its application, Sonos is compatible with many different third-party music streaming services. When Google publicly launched its own streaming music service – Google Play Music – in late 2011, Sonos worked with Google to integrate the Google Play Music service into the Sonos ecosystem. As a result, Google Play Music launched on the Sonos platform in 2014. *See, e.g.*, Ex. 11.

13. This should have benefited everyone: Sonos's customers gained access to another streaming service and Google Play Music users gained access to Sonos's devices. But as the press recognized at the time, Sonos's integration work with Google was especially "deep" and therefore gave Google a wide aperture through which to view Sonos's proprietary technology. *Id*. (2014 Wired: "This is the first time this sort of deep integration has happened between a third party music service and Sonos."). The copying soon followed.

14. Just eighteen months later, in 2015, Google began willfully infringing Sonos's patents. On information and belief, Google used the knowledge it had gleaned from Sonos to build and launch its first wireless multi-room audio product – Chromecast Audio.

15. Google's Chromecast Audio began what has turned into Google's relentless effort to copy Sonos and use Sonos's patented technology. For example, although Google's original Chromecast Audio did not yet include Sonos's patented multi-room audio functionality, even when it was launched Google was working to add that Sonos-patented feature. *See* Ex. 12 (2015 The Guardian: "Google is also working on multi-room audio streaming using the Chromecast Audio, but it will not support the popular feature out of the box."). And, when Google added the infringing feature, the press immediately noted how this "major feature update" made Google's product even more "like the ones made by Sonos:"

> Google's recently-launched Chromecast Audio adapter is getting a major feature update this week: Consumers will now be able to group multiple Chromecast audio adapters to stream their favorite music simultaneously in more than one room,

> similar to the multi-room support available for internet-connected loudspeakers like the ones made by Sonos.

Ex. 13 (2015 *Variety* article entitled "Google's Chromecast Audio Adapter Gets Multi-Room Support Similar to Sonos"); *see also* Ex. 14 (2015 *Pocket-Lint*) ("You control your Sonos experience with one app. Well, thanks to a new software rollout, Chromecast Audio can pretty much do the same thing.").

16. This has become a consistent pattern. Time and again, Google has added features to its products that first appeared in Sonos's products and which make use of Sonos's patented technology.

GOOGLE'S INFRINGEMENT ACCELERATES

17. Since 2015, Google's misappropriation of Sonos's patented technology has proliferated. Google has expanded its wireless multi-room audio system to more than a dozen infringing products, including the Google Home Mini, Google Home, Google Home Max, and Pixel phones, tablets, and laptops. And Google has persisted in infringing even though Sonos has warned Google of its infringement on at least four separate occasions dating back to 2016.

18. For example, in 2016 (a year after Google launched the Chromecast Audio wireless adapter), Google released the Google Home multi-room audio player (which was controlled by Google's rebranded multi-room controller app – the Google Home app). Unlike the Chromecast Audio, the Google Home added an internal speaker driver making it an "all-in-one" audio player akin to Sonos's prior Play:1, Play:3, and Play:5 products.

19. Sonos raised the issue of infringement as to these products with Google as early as August 2016. Sonos hoped that Google would respect Sonos's intellectual property and the extensive work Sonos had put into inventing and developing its products. But Google did no such thing.

20. In October 2016, Sonos put Google on notice of infringement of 28 Sonos patents, including asserted United States Patent No. 9,344,206. Google, however, did not stop infringing.

Instead, it doubled down and introduced new infringing products, making use of *even more* patented technology from Sonos.

21. For example, in 2017, eight years after Sonos introduced its first all-in-one audio player – the Play:5 – Google released its first all-in-one audio players – the Google Home Max and the Google Home Mini. Google's Home Max in particular was seen as a "Sonos Clone" and a "not-so-subtle copy of the [Sonos] Play:5 speaker…." Ex. 15. As explained by Gizmodo, "[i]t's also hard not to see the [Google Home Max] device as something of a jab at Sonos." *Id.*; *see also, e.g.*, Ex. 16 (2017 Android Central: "You can't help but look at Google Home Max… and come to the conclusion that Google is sticking its nose where Sonos has been for years.").

22. Therefore, in January 2018, and then again in July 2018, Sonos put Google on notice that it was infringing even more Sonos patents, including asserted United States Patent No. 9,219,460. Then again, in February 2019, Sonos put Google on notice of infringement of 100 Sonos patents, including asserted United States Patent No. 9,967,615.

23. Nothing Sonos did, however, deterred Google from expanding its infringement. Google's infringing product line now includes at least the Chromecast, Chromecast Ultra, Chromecast Audio, Chromecast with Google TV, Home Mini, Nest Mini, Home, Home Max, Home Hub, Nest Hub, Nest Hub Max, Nest Audio, and Nest Wifi Point (individually or collectively, "Google Audio Player(s)"), all of which can be controlled by, for example, the YouTube Music app, the Google Play Music app, the YouTube app, and the Google Home app (individually or collectively, "Google App(s)"). *See, e.g.*, Exs. 17-27.

24. In addition to providing the Google Apps for controlling the Google Audio Players, Google also offers various infringing hardware controllers that are pre-installed with the Google Play Music app, YouTube app, and/or YouTube Music app (and capable of downloading and executing the Google Apps that are not pre-installed). These infringing hardware controllers include, for example, Google's "Pixel" phones, tablets, and laptops (e.g., the Pixel 3, Pixel 3 XL, Pixel 3a, Pixel 3a XL, Pixel 4, Pixel 4 XL, and Pixel 4a phones, the Pixel Slate tablet, and the

Pixelbook and Pixelbook Go laptops) (individually or collectively, "Google Pixel Device(s)"). *See, e.g.*, Exs. 28-32.

25. Herein, "Google Wireless Audio System" refers to one or more Google Audio Players, one or more Google Pixel Devices, and/or one or more Google Apps.

26. In order to hold Google accountable for its willful infringement of Sonos's patents, Sonos filed a complaint in January 2020 asking the United States International Trade Commission ("ITC") to institute an investigation into Google's unlawful importation into and sale in the United States of infringing products. The ITC instituted an investigation, *In re Certain Audio Players and Controllers, Components Thereof, and Products Containing Same*, Inv. No. 337-TA-1191 to determine whether Google's audio players and controllers infringe five Sonos patents directed to fundamental features such as playing music on multiple speakers in synchrony, playing music in stereo over two or more players, a controller that can easily setup a player on a wireless network, and playback-control features such as controlling both the volume of individual speakers and a group of speakers.

27. While the ITC Investigation has been pending, Google has continued to increase its infringement. For example, press reports indicate that Google is introducing new products and changes that mean Google is "one step closer to replacing your Sonos system." Ex. 33; *see also* Ex. 44 ("The new functionality appears to be the most direct challenge to the likes of Sonos, which has enjoyed enormous success by creating a series of connected speakers and soundbars that can play music simultaneously – or individually."). The press has similarly noted that Google's new speaker "could be a new rival for the likes of the Sonos One, the best smart speaker you can buy in 2020." Ex. 34; *see also* Ex. 44 ("Just like Sonos, you can also change the volume on each speaker individually from the main interface."). And press reports indicate that Google has expanded its use of Sonos's stereo pair technology into the new smart-speakers even though Google is *currently* being sued for infringing a Sonos patent on this technology. Exs. 35, 44.

28. Google itself has also highlighted the importance of its use of Sonos's technology. For example, Google' Chris Chan publicly stated that "[c]ontrolling the audio throughout my

home, no matter who's listening, has been incredibly helpful" and that "[t]oday, we're expanding that control. You can already manually group Nest devices in order to play the same music on various speakers at the same time, and now we're launching multi-room control so you can dynamically group multiple cast-enabled Nest devices (speakers, Smart Displays, Chromecasts) in real-time to fill multiple rooms with music." Ex. 35; *see also* Ex. 44. Again, Google has expanded its use of this technology *while* it is being sued for infringing Sonos's patents on this precise technology.

29. Google's aggressive and deliberate expansion of its use of Sonos's patented technology has led observers to conclude that "[n]o market is safe from [the] search engine monster" and that Google was specifically "offering new products to compete with Sonos in the music streaming market." *See* Ex. 36.

GOOGLE'S CONTINUED INFRINGEMENT FORCES THIS SUIT

30. In the face of Google's unrelenting infringement, Sonos has no choice but to bring this suit. In this action, Sonos asserts patents that are not at issue in the ITC or the related district court action. Sonos is also accusing Google's Wireless Audio System of infringing different patented features than are at issue in either of those actions.

31. Sonos's ITC suit addressed Google's infringement of Sonos patents covering fundamental aspects of wireless, whole-home audio systems. While groundbreaking, those patents represent only some of Sonos's ongoing innovation from its inception to today. Through its foresight, substantial investment, and relentless pursuit of excellence, Sonos built on its previous success and invented a number of key features consumer have grown to expect and demand in streaming music listening.

32. For example, as explained more fully below, Sonos's U.S. Patent Nos. 9,967,615 and 10,779,033 (the "'615 Patent" and the "'033 Patent," respectively) cover key aspects of Sonos's inventive approach for streaming music from a cloud-based service to a media playback system, including technology for transferring playback responsibility for a cloud-based stream of

media content from a user's device, such as a smart phone, to a media playback system that is then configured to retrieve and play back the cloud-based media content.

33. Sonos was well ahead of the field when it began to develop these inventions in 2011. At that time, Sonos's audio system, including its smart-phone app controller, was in a category all its own. Moreover, streaming content from cloud-based media services for playback by computers – let alone other types of networked devices like smart phones and smart speakers – was in its infancy. Nonetheless, at a time years before Google released its first Chromecast product, Sonos envisioned a novel experience of continuous and intuitive control of a user's entire streaming listening experience, across multiple networked devices, including smart phones and/or smart speakers. That vision gave rise to the innovation of technology for enabling seamless transition of playback responsibility for cloud-based media content between different networked devices, such as a smart phone and a smart speaker. This paradigm is now fundamental across the entire streaming industry as user expectations of continuous listening experiences have continued to converge with Sonos's vision.

34. Similarly, Sonos's U.S. Patent Nos. 9,344,206 and 10,469,966 (the "'206 Patent" and the "'966 Patent," respectively) cover some of Sonos's inventions related to creating, managing, and invoking "zone scenes" to configure how multiple players work together. With these patents, Sonos once again anticipated what consumers would want and invented a new feature for its system. Using the inventions of the '206 and '966 Patents, playback devices can be grouped together for synchronous playback in an easy and intuitive manner using "zone scenes." Advantageously, such a "zone scene" can be accessed and invoked by multiple devices and in various ways (*e.g.*, by voice) even when the particular controller that created the "zone scene" is not on the network.

35. In addition, Sonos's U.S. Patent No. 9,219,460 (the "'460 Patent") covers a Sonos invention related to dynamically adjusting the equalization of a playback device based on its environment. Naturally, consumers want their speakers to sound great, regardless of the environment in which the playback device is operating, but changes in the playback device's

listening environment could impact sound quality. For example, a playback device may be configured to perform advantageously in a small room, but nonetheless may come to be positioned outdoors. When operating outdoors, boosting the bass levels of the playback may result in an improved listening experience for some consumers. However, previous technology for setting the equalization parameters for a playback device made it very difficult to optimize the playback device's equalization parameters for its listening environment. The '460 Patent provides technology that enables a playback device to adjust its own equalization settings based on one or more reflection characteristics of an audio signal in order to optimally match the playback device's listening environment.

36. Sonos provided a pre-filing copy of this Complaint to Google, thereby providing clear pre-suit notice of infringement of the patents-in-suit. Google, however, has never given any indication that it is willing to stop infringing, and did not do so in response to receiving a draft of this complaint.

37. On information and belief, Google is unwilling to stop infringing because its infringement of Sonos's patented inventions has paved the way for Google to generate billions of dollars in revenue. A December 2018 market report by Royal Bank of Canada ("RBC"), for example, concluded that Google sold over 40 million Google Home devices in the U.S. and that Google generated $3.4 billion in Google Home revenue in 2018 alone. Ex. 37 at pp. 1, 4, 14-15. RBC also found that, as of August 2017, Google had sold more than 55 million Chromecast devices and that Google generated almost $1 billion in Chromecast revenue in 2018. *Id*. at pp. 4, 16, 18. Further, RBC estimated that, in 2018, Google generated $3.4 billion in Pixel device revenue. *Id*. at pp. 4, 8.

38. By 2021, RBC estimates that Google will be annually selling over 100 million Google Home devices in the U.S. and generating over $8 billion in Google Home revenue. *Id*. at pp. 4, 14-15. In addition, by 2021, RBC estimates that Google will annually generate $2.4 billion in Chromecast revenue and nearly $7 billion in Pixel device revenue. *Id*. at pp. 4, 8, 18.

39. The revenue obtained from the sale of Google's hardware devices vastly understates the value to Google of infringing Sonos's patents. On information and belief, Google is intentionally selling the infringing products at a discount and/or as a "loss leader" with the expectation that this will allow Google to generate even more revenue in the future – *e.g.*, by powering Google's continued dominance of the market for search advertising. In particular, Google's infringement of Sonos's patented inventions has helped and/or will help Google generate significant revenue from the use of Google's hardware devices including advertising, data collection, and search via the Google Wireless Audio Systems. As the *New York Post* explained, "Amazon and Google both discounted their home speakers so deeply over the holidays that they likely lost a few dollars per unit … hoping to lock in customers and profit from later sales of goods and data about buying habits." Ex. 38. Similarly, *News Without Borders* explained that companies like Google are using their "smart speaker" devices as "'loss leader[s]' to support advertising or e-commerce." Ex. 39.

40. On information and belief, Google's copying of Sonos's patented inventions has also helped and/or will help Google generate significant revenue from driving its users to make purchases such as streaming music subscriptions and retail purchases via the Google Wireless Audio Systems. For example, an NPR "smart speaker" survey found that 28% of survey respondents agreed that "[g]etting [a] Smart Speaker led [them] to pay for a music service subscription," and Google offers two such subscriptions – Google Play Music and YouTube Music. Ex. 40 at p. 20. Likewise, the NPR survey also found that 26% of respondents use their smart speakers "regularly" to "add [items] to shopping list." *Id*. at p. 14; *see also, e.g.*, Ex. 39 (stating that companies like Google are using their "smart speaker" devices as "'loss leader[s]' to support… e-commerce.").

41. On information and belief, Google is willfully infringing Sonos's patents as part of Google's calculated strategy to vacuum up invaluable consumer data from users and, thus, further entrench the Google platform among its users and fuel its dominant advertising and search platforms.

42. Google's infringement – and its strategy to sell its infringing products at a loss to develop alternative revenue streams – has caused significant damage to Sonos. For example, the Google Home Mini predatorily implemented Sonos's valuable patented technology into an all-in-one wireless multi-room product that Google sells at a highly subsidized price point or even gives away for free. Ex. 41 ("At $49, Google Home Mini works on its own or you can have a few around the house, giving you the power of Google anywhere in your home."); Ex. 39 ("Google partnered with Spotify to offer Home Minis as a free promotion for Spotify Premium customers. Spotify's premium userbase is nearly 90 million, so if even a fraction of users take the free offer, a massive influx of Google smart speakers will enter the market.").

THE PARTIES

43. Plaintiff Sonos, Inc. is a Delaware corporation with its principal place of business at 614 Chapala Street, Santa Barbara, California 93101. Sonos is the owner of the patents-in-suit. Sonos holds all substantial rights, title and interest in and to the Asserted Patents.

44. Defendant Google LLC is a Delaware limited liability corporation with its principal place of business at 1600 Amphitheatre Parkway, Mountain View, CA 94043. Google maintains a physical address in this district at 500 West 2nd Street, Austin, Texas, 78701. Google may be served with process through its registered agent, the Corporation Service Company, at 211 East 7th Street, Suite 620, Austin Texas 78701. Google is registered to do business in the State of Texas and has been since at least November 17, 2006.

45. Google LLC is one of the largest technology companies in the world and conducts product development, engineering, sales, and online retail, search, and advertising operations in this District.

46. Google LLC directly and/or indirectly develops, designs, manufactures, distributes, markets, offers to sell, sells, and/or imports the infringing Google Wireless Audio System at issue in this litigation in/into the United States, including in the Western District of Texas, and otherwise purposefully directs infringing activities to this District in connection with its Google Wireless Audio System.

JURISDICTION AND VENUE

47. This action for patent infringement arises under the Patent Laws of the United States, 35 U.S.C. § 1 et. seq. This Court has original jurisdiction under 28 U.S.C. §§ 1331 and 1338.

48. This Court has personal jurisdiction over Google because, pursuant to Fed. R. Civ. P. 11(b)(3), Google has: (1) availed itself of the rights and benefits of the laws of the State of Texas, (2) transacted, conducted, and/or solicited business and engaged in a persistent course of conduct in the State of Texas (and in this District), (3) derived substantial revenue from the sales and/or use of products, such as the infringing Google Wireless Audio System, in the State of Texas (and in this District), (4) purposefully directed activities (directly and/or through intermediaries), such as shipping, distributing, offering for sale, selling, and/or advertising its infringing Google Wireless Audio System, at residents of the State of Texas (and residents in this District), (5) delivered its infringing Google Wireless Audio System into the stream of commerce with the expectation that the Google Wireless Audio System will be used and/or purchased by consumers, and (6) committed acts of patent infringement in the State of Texas (and in this District).

49. This Court also has personal jurisdiction over Google because it is registered to do business in the State of Texas and has one or more regular and established places of business in the Western District of Texas.

50. Venue is proper in this District under the provisions of 28 U.S.C. § 1400(b) because, as noted above, Google has committed acts of infringement in this district and has one or more regular and established places of business in this district. Google has also repeatedly admitted that venue is proper in this District for various patent cases. *See e.g., Solas OLED Ltd. v. Google, Inc.* (WDTX Case No. 6-19-cv-00515) and *VideoShare, LLC v. Google LLC et al* (WDTX Case No. 6-19-cv-00663).

THE PATENTS-IN-SUIT

U.S. Patent No. 9,967,615

51. Sonos is the owner of U.S. Patent No. 9,967,615 (the "'615 Patent"), entitled "Networked Music Playback," which was duly and legally issued by the United States Patent and Trademark Office ("USPTO") on May 8, 2018. A copy of the '615 Patent, is attached hereto as Exhibit 1.

52. The '615 Patent relates generally to technology for facilitating transfer of playback responsibility from a user's device to a media playback system.

53. The '615 Patent recognized that "[t]echnological advancements have increased the accessibility of music content, as well as other types of media…." '615 Patent at 1:19-20. This allowed users to access audio and video content over the Internet. *Id.* at 1:21-26.

54. But, the '615 Patent identified a particular problem and provided an unconventional technological solution. Specifically, the patent recognized that "[w]ired or wireless networks can be used to connect one or more multimedia playback devices for a home or other location playback network (*e.g.*, a home music system)." '615 Patent at 1:66-2:2. This means that "[m]usic and/or other multimedia content can be shared among devices and/or groups of devices (also referred to herein as zones) associated with a playback network." *Id.* at 2:6-9. The '615 Patent is directed to a method, tangible media, and controller that "facilitate streaming or otherwise providing music from a music-playing application (*e.g.*, browser-based application, native music player, other multimedia application, and so on) to a multimedia content playback (*e.g.*, Sonos™) system." *Id.* at 2:10-14.

55. The '615 Patent provides an unconventional technological solution to this problem. For example, the '615 Patent describes an "Example Controller" that "can be used to facilitate the control of multi-media applications…." '615 Patent at 9:8-14. "In particular, the controller 500 is configured to facilitate a selection of a plurality of audio sources available on the network and enable control of one or more zone players … through a wireless network interface 508." *Id.* at 9:14-18. Further, the '615 Patent describes embodiments that "enable a user to stream

music from a music-playing application (*e.g.*, browser-based application, native music player, other multimedia application and so on) to a local multimedia content playback (*e.g.*, Sonos™) system." '615 Patent at 12:8-12. More specifically, the '615 Patent teaches that while "a user listens to a third party music application (*e.g.*, Pandora™ Rhapsody™, Spotify™, and so on)" on a user device, such as the user's "smart phone," the user can "select[] an option to continue playing [the current] channel on her household music playback system (*e.g.*, Sonos™)," which will cause the user's "playback system" to "pick[] up from the same spot on the selected channel that was on her phone and output[] that content (*e.g.*, that song) on speakers and/or other playback devices connected to the household playback system." *Id.* at 12:44-53; *see also id.* at 13:1-53.

56. The '615 Patent goes on to teach specific technology for facilitating this transfer of playback responsibility from the user's device to the user's playback system. For instance, the '615 Patent teaches that one aspect of this technology involves causing data for retrieving network-based media content (such as a uniform resource locator (URI)) to be passed to a playback device in the playback system so that the playback device can "run on its own to fetch the content" from a networked audio source, such as a "cloud" server that is accessible over the Internet. *Id.* at 12:53-63; *see also id.* at 12:63-67 (describing that "[a] third party application can open or utilize an application programming interface (API) to pass music to the household playback system without tight coupling to that household playback system"); 15:47-16:19 (describing a "throw it over the wall" approach in which "a third party application provides a multimedia playback device (*e.g.*, a Sonos™ zone player (ZP)) with enough information about content (*e.g.*, an audio track) so that . . . the local playback system (*e.g.*, SonosNet™) can directly access a source of the content and . . . play the content directly off the network *(e.g.*, the Internet) or cloud," where the "connection between the third-party application and the local playback device (*e.g.*, Sonos ZonePlayer™) can be direct over a local area network (LAN)" or "remote through a proxy server in the cloud"); 16:53-17:4 (describing various embodiments for "queue management" associated with the transfer of playback from a control device to a playback system, including an embodiment where a "shared queue is provided between the local playback system

and the third party application to keep the local system and the application synchronized"). Further, the '615 Patent teaches that another aspect of this technology involves transitioning the user's device into a mode in which it functions to control the playback of the media content by the user's playback system after the transfer. *Id.* at 16:20-42, 17:5-20. In this way, the technology taught by the '615 Patent provides for intuitive and seamless transfer of playback responsibility from a user's device to a media playback system.

57. In line with these teachings, the '615 Patent claims devices, computer-readable media, and methods for facilitating transfer of playback responsibility from a user's device to a media playback system.

58. For example, claim 13 of the '615 Patent recites a non-transitory computer readable storage medium including instructions for execution by a processor that, when executed, cause a control device to perform various functions that facilitate transfer of playback responsibility from the device to a media playback system. *See* '615 Patent, claim 13. When the instructions are executed, the control device is initially operable to (i) cause a graphical interface to display a control interface including one or more transport controls to control playback by the control device, (ii) identify playback devices connected to a local area network, (iii) cause the graphical interface to display a selectable option for transferring playback from the control device, and (iv) detect a set of inputs to transfer playback from the control device to a particular playback device. *Id.* Additionally, the instructions configure the control device so that, after detecting the set of inputs to transfer playback from the control device to the particular playback device, the control device is operable to cause playback to be transferred from the control device to the particular playback device by (a) causing one or more first cloud servers to add multimedia content to a local playback queue on the particular playback device, wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service, (b) causing playback at the control device to be stopped, and (c) modifying the one or

more transport controls of the control interface to control playback by the playback device. *Id.* Additionally yet, the instructions configure the control device so that the control device is operable to cause the particular playback device to play back the multimedia content, which involves the particular playback device retrieving the multimedia content from one or more second cloud servers of a streaming content service and playing back the retrieved multimedia content. *Id.*

U.S. Patent No. 10,779,033

59. Sonos is the owner of U.S. Patent No. 10,779,033 (the "'033 Patent"), entitled "Systems And Methods For Networked Music Playback," which was duly and legally issued by the United States Patent and Trademark Office ("USPTO") on September 15, 2020. A copy of the '966 Patent, is attached hereto as Exhibit 2.

60. The '033 Patent is related to the '615 Patent in that they are both continuations of application No. 13/341,237, filed on December 30, 2011, now U.S. Patent No. 9,654,821. Thus, the '033 and '615 Patents share essentially the same specification. Sonos incorporates by reference and re-alleges paragraphs 52-58 of this Complaint as if fully set forth herein.

61. Like the '615 Patent, the '033 Patent claims devices, computer-readable media, and methods for facilitating transfer of playback responsibility from a user's device to a media playback system, which provide an unconventional solution to the technological problem described in the '615 Patent.

62. For example, claim 1 of the '033 Patent recites a computing device with specific hardware configurations, including a non-transitory computer-readable medium that stores program instruction that can be executed by the device's processor(s). *See* '033 Patent, claim 1. When the instructions are executed, the computing device can initially operate in a first mode in which it is configured for playback of a remote playback queue provided by a cloud-based computing system associated with a cloud-based media service. *Id.* In that mode, the computing device is operable to (i) display a representation of one or more playback devices in a media playback system that are communicatively coupled to the computing device over a data network and available to accept playback responsibility for the remote playback queue, and (ii) while

displaying the representation of the one or more playback devices, receive user input indicating a selection of at least one given playback device from the one or more playback devices. *Id.* Additionally, the instructions configure the computing device so that, based on receiving the user input, the computing device is operable to transmit an instruction for the at least one given playback device to take over responsibility for playback of the remote playback queue from the computing device, wherein the instruction configures the at least one given playback device to (i) communicate with the cloud-based computing system in order to obtain data identifying a next one or more media items that are in the remote playback queue, (ii) use the obtained data to retrieve at least one media item in the remote playback queue from the cloud-based media service; and (iii) play back the retrieved at least one media item. *Id.* Additionally yet, the instructions configure the computing device so that the computing device is operable to detect an indication that playback responsibility for the remote playback queue has been successfully transferred from the computing device to the at least one given playback device, and then after detecting the indication, transition from (a) the first mode in which the computing device is configured for playback of the remote playback queue to (b) a second mode in which the computing device is configured to control the at least one given playback device's playback of the remote playback queue and the computing device is no longer configured for playback of the remote playback queue. *Id.*

U.S. Patent No. 9,344,206

63. Sonos is the owner of U.S. Patent No. 9,344,206 (the "'206 Patent"), entitled "Method And Apparatus For Updating Zone Configurations In A Multi-Zone System," which was duly and legally issued by the United States Patent and Trademark Office ("USPTO") on May 17, 2016. A copy of the '206 Patent, is attached hereto as Exhibit 3.

64. The '206 Patent relates generally to consumer electronics and human-computer interaction and, more specifically, to controlling or manipulating a plurality of multimedia players in a multi-zone system. *See, e.g.*, '206 Patent at 1:25-29.

65. The ’206 Patent recognized that users demand not only quality audio reproduction but also a system that allows multiple players to access music from different sources. ’206 Patent at 1:30-40. Before the ’206 Patent, a conventional multi-zone audio system might include a number of audio sources, but each audio source had to be connected to its own amplifier and a set of speakers and was typically installed in one place. *Id.* at 1:40-44. This had inherent limitations. “In order to play an audio source at one location, the audio source must be provided locally or from a centralized location. When the audio source is provided locally, the multi-zone audio system functions as a collection of many stereo systems, making source sharing difficult. When the audio source is provided centrally, the centralized location may include a juke box, many compact discs, an AM or FM radio, tapes, or others. To send an audio source to an audio player demanding such source, a cross-bar type of device is used to prevent the audio source from going to other audio players that may be playing other audio sources.” *Id.* at 1:44-44.

66. Moreover, as the ’206 Patent recognized, “[i]n order to achieve playing different audio sources in different audio players, the traditional multi-zone audio system is generally either hard-wired or controlled by a pre-configured and pre-programmed controller.” ’206 Patent at 1:56-59. Such a system created problems. “While the pre-programmed configuration may be satisfactory in one situation, it may not be suitable for another situation. For example, a person would like to listen to broadcast news from his/her favorite radio station in a bedroom, a bathroom and a den while preparing to go to work in the morning. The same person may wish to listen in the den and the living room to music from a compact disc in the evening. In order to satisfy such requirements, two groups of audio players must be established. In the morning, the audio players in the bedroom, the bathroom and the den need to be grouped for the broadcast news. In the evening, the audio players in the den and the living room are grouped for the music. Over the weekend, the audio players in the den, the living room, and a kitchen are grouped for party music. Because the morning group, the evening group and the weekend group contain the den, it can be difficult for the traditional system to accommodate the requirement of dynamically managing the ad hoc creation and deletion of groups.” *Id.* at 1:59-2:10.

67. Thus, the '206 Patent recognized "a need for dynamic control of the audio players as a group" and a system in which "the audio players may be readily grouped." '206 Patent at 2:11-13. The invention of the '206 Patent would, thus, overcome the problems "in a traditional multi-zone audio system [where] the audio players have to be adjusted one at a time, resulting in an inconvenient and non-homogenous audio environment." *Id.* at 2:13-16.

68. The '206 Patent provided an unconventional solution to this technological problem. "In general, the present invention pertains to controlling a plurality of multimedia players, or simply players, in groups." '206 Patent at 2:28-29. One specific aspect of the grouping technology that is taught by the '206 Patent involves a controller with a user interface that permits a user to configure and save a "zone scene," which may comprise a "predefined" grouping of zone players that can later be "activated" (or "invoked") in order to group the zone players in the "zone scene" together for synchronous playback. *Id.* at 2:30-53, 2:60-3:4, 8:19-10:45. The '206 Patent explains that this "zone scene" technology for grouping zone players together for synchronous playback provides improvements over the existing technology for grouping zone players together for synchronous playback, which involved defining the group membership at the time that the group was to be invoked – particularly in situations where a larger number of zone players are to be grouped together for synchronous playback. *Id.* at 8:19-55. For instance, the benefits highlighted by the '206 Patent include (i) allowing a group of zone players to be "predefined" as part of a "zone scene" so that the group's membership need not be defined at the time that the group is to be invoked, (ii) allowing a predefined group to be invoked without requiring the zone players in the group to be separated from other groups beforehand, and (iii) allowing zone players to exist as part of multiple different predefined groups that can be invoked in order to dynamically group the zone players for synchronous playback. *Id.* at 8:19-10:45.

69. In line with these teachings, the '206 Patent claims devices, computer-readable media, and methods for managing and using "zone scenes" to facilitate grouping of zone players. For example, claim 1 of the '206 Patent recites a "multimedia controller including a processor" that is configured to (i) receive, via a network interface, a zone configuration from a first

independent playback device of a plurality of independent playback devices, wherein the zone configuration is configured via the controller and maintained at the first independent playback device, and wherein the zone configuration characterizes one or more zone scenes, each zone scene identifying a group configuration associated with two or more of the plurality of independent playback devices, and (ii) cause a selectable indication of the received zone configuration to be displayed, wherein the displayed selectable indication is selectable to cause one or more of the zone scenes to be invoked by two or more of the plurality of independent playback devices. *See* '206 Patent, claim 1.

U.S. Patent No. 10,469,966

70. Sonos is the owner of U.S. Patent No. 10,469,966 (the "'966 Patent"), entitled "Zone Scene Management," which was duly and legally issued by the United States Patent and Trademark Office ("USPTO") on November 5, 2019. A copy of the '966 Patent, is attached hereto as Exhibit 4.

71. The '966 Patent is related to the '206 Patent in that they are both continuations of application No. 13/896,829, filed on May 17, 2013, now U.S. Patent No. 8,843,228. Thus, the '966 and '206 Patents share essentially the same specification. Sonos incorporates by reference and re-alleges paragraphs 64-69 of this Complaint as if fully set forth herein.

72. The '906 Patent claims devices, computer-readable media, and methods for managing and using "zone scenes" to facilitate grouping of zone players, which provides an unconventional solution to the technological problems related to grouping zone players that are described in the '906 Patent.

73. For example, claim 1 of the '966 Patent describes a computing device with a processor that can execute instructions stored in the controllers non-transitory, computer-readable medium. Those instructions, when executed, cause the computing device to be operable to (i) receive a first request to create a first zone scene comprising a first predetermined grouping of zone players that are to be configured for synchronous playback when the first zone scene is invoked, and (ii) based on the first request, cause creation of the first zone scene, cause an

indication of the first zone scene to be transmitted to a first zone player in the first zone scene, and cause storage of the first zone scene. *See, e.g.*, '966 Patent, claim 1. Additionally, the instructions, when executed, cause the computing device to be operable to (i) receive a second request to create a second zone scene comprising the first zone player and at least one other zone player that is not in the first zone scene, and (ii) based on the second request, cause creation of the second zone scene, cause an indication of the second zone scene to be transmitted to the first zone player, and cause storage of the second zone scene. *Id.* Additionally yet, the instructions, when executed, cause the computing device to be operable to (i) display representations of the first and second zone scenes, (ii) while displaying the representations, receive a third request to invoke the first zone scene, and (iii) based on the third request, cause the first zone player to transition from operating in a standalone mode to operating in accordance with the first predefined grouping of zone players so that the first zone player is configured to coordinate with at least the second zone player to output media in synchrony with output of media by at least the second zone player. *Id.*

U.S. Patent No. 9,219,460

74. Sonos is the owner of U.S. Patent No. 9,219,460 (the "'460 Patent"), entitled "Audio Settings Based on Environment," which was duly and legally issued by the United States Patent and Trademark Office ("USPTO") on December 22, 2015. A copy of the '460 Patent, is attached hereto as Exhibit 5.

75. The '460 Patent relates generally to "consumer goods and, more particularly, to methods, systems, products, features, services, and other elements directed to media playback or some aspect thereof." '460 Patent at 1:6-9. More specifically, the '460 Patent is directed to dynamically adjusting the equalization of a playback device based on the environment in which the playback device is operating. *See, e.g.*, *id*. at 1:64-66.

76. The '460 Patent recognized that "[w]hile a playback device may be factory configured to perform advantageously in a typical operating environment, the factory configuration may not be ideal for all environments." '460 Patent at 1:66-2:2. According to the

'460 Patent, "adjusting the equalization of the playback device based on the current operating environment may improve the listening experience for some listeners." *Id*. at 2:3-5.

77. The '460 Patent recognized that there are several problems with existing technology for adjusting an audio player's equalization. '460 Patent at 2:12-14. For instance:

> First, the adjustment process is often overlooked by the user because, for example, the user may be required to initiate the adjustment and position the microphone. Second, the adjustment process requires a separate microphone, which may not be included with any of the components of the audio system. Third, the manual approach does not lend itself to frequent adjustment when one or more of the speakers may be re-positioned in different locations throughout a home or outdoors.

Id. at 2:23-32.

78. The '460 Patent provides an unconventional technological solution to these problems. For example, the '460 Patent discloses a playback device that "emit[s] an audio signal, such as a pulse, . . . [which] may encounter various objects, such as walls and furniture, throughout the environment." '460 Patent at 2:37-42. The ''460 Patent further discloses that "[w]hen an object is encountered, the object may variably reflect or absorb portions of the audio signal," and "[a]t some point, a portion of the reflected audio signal may reflect back toward the playback device from which the audio signal was emitted." *Id*. at 2:42-50. According to the '460 Patent, "[t]he microphone of the playback device may then detect at least a portion of the reflected audio signal," and "[i]n response to detecting the reflected audio signal, the playback device may determine one or more reflection characteristics based on the reflected audio signal." *Id*. at 2:50-55. Moreover, the '460 Patent discloses that "[t]he playback device may then adjust an equalization setting of the playback device based on the one or more reflection characteristics," and "[o]nce the equalization setting is adjusted, the playback device may then play an audio track according to the equalization setting." *Id*. at 3:6-26.

79. In line with these teachings, the '460 Patent claims devices, systems, and methods for dynamically adjusting the equalization of a playback device based on the environment in which the playback device is operating, which provide an unconventional solution to the technological problems described in the '460 Patent. For example, claim 15 of the '460 Patent

describes a playback device with a speaker, a microphone that is physically coupled to the speaker, a processor, a network interface, a data storage, and a program logic stored in the data storage and executable by the processor. The program logic, when executed, causes the playback device to be operable to (i) emit a first audio signal from the speaker, and (ii) detect a second audio signal via the microphone that is physically coupled to the speaker, where at least a portion of the second audio signal is a reflection of the first audio signal. *See* '460 Patent, claim 15. Additionally, the program logic, when executed, causes the playback device to be operable to (i) in response to detecting the second audio signal, determine a first reflection characteristic based on at least the second audio signal, (ii) adjust an equalization setting of the playback device based on at least the first reflection characteristic, and (iii) play, via the speaker, an audio track according to the adjusted equalization setting. *Id.*

COUNT I: INFRINGEMENT OF U.S. PATENT NO. 9,967,615

80. Sonos incorporates by reference and re-alleges paragraphs 1-79 of this Complaint as if fully set forth herein.

81. Google and/or users of the Google Wireless Audio System have directly infringed (either literally or under the doctrine of equivalents) and continue to directly infringe one or more of the claims of the '615 Patent, in violation of 35 U.S.C. § 271(a), by making, using, offering for sale, and/or selling the Google Wireless Audio System within the United States and/or importing the Google Wireless Audio System into the United States without authority or license.

82. As just one non-limiting example, set forth below is an exemplary infringement claim chart for claim 13 of the '615 Patent in connection with the Google Wireless Audio System. This claim chart is based on publicly available information. Sonos reserves the right to modify this claim chart, including, for example, on the basis of information about the Google Wireless Audio System that it obtains during discovery.

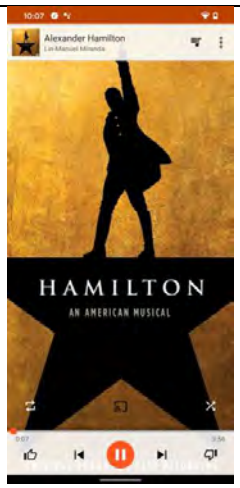
Claim: 13	Chromecast-Enabled Computing Devices
A tangible, non-transitory computer readable storage	At least each smartphone, tablet, and computer running the YouTube Music app, the Google Play Music app, the YouTube app and/or other native or web-based Chromecast-enabled apps (where a computing

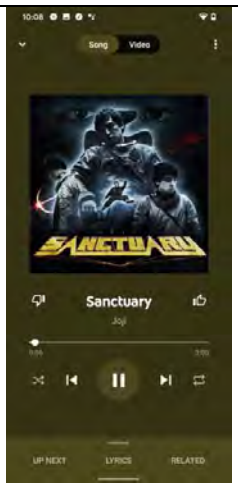
medium including instructions for execution by a processor, the instructions, when executed, cause a control device to implement a method comprising:	device installed with at least one of these Chromecast-enabled apps is referred to herein as a "Chromecast-enabled computing device"[1,2]) comprises a "control device," as recited in claim 13. At least each Home Mini, Nest Mini, Home, Home Max, Home Hub, Nest Hub, Nest Hub Max, Nest Wifi Point, Chromecast, Chromecast Audio, Chromecast Ultra, Chromecast with Google TV, and Nest Audio ("Chromecast-enabled media player") is a data network device configured to process and output audio, and thus, comprises a "playback device" as recited in claim 13. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs; https://store.google.com/us/product/google_home_max?hl=en-US; https://store.google.com/us/product/google_home_max_partners?hl=en-US; https://store.google.com/product/chromecast_apps?utm_source=chromecast.com. In addition to being a "playback device" as recited in claim 13, each Home Hub, Nest Hub, and Nest Hub Max (referred to herein as a "Hub media player") is installed with Home/Nest Hub controller software such that the given Hub media player also comprises a "control device," as recited in claim 13. *See, e.g.,* https://store.google.com/us/product/google_nest_hub?hl=en-US#overview-modal-music; https://store.google.com/us/product/google_nest_hub_max?hl=en-US; https://support.google.com/googlenest/answer/9165738?hl=en-GB&ref_topic=7030084. Each Chromecast-enabled computing device includes a tangible, non-transitory computer-readable storage medium comprising instructions that, when executed by a Chromecast-enabled computing device's processor, cause that Chromecast-enabled computing device to perform the functions identified below. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs. Likewise, each

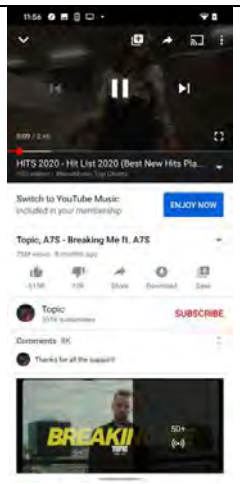
[1] Any reference to a "Chromecast-enabled computing device" or "Chromecast-enabled media player" includes each version and generation of such device/player unless otherwise noted.

[2] Each Google "Pixel" smartphone, tablet, and computer (*e.g.*, the Pixel 3, Pixel 3 XL, Pixel 3a, Pixel 3a XL, Pixel 4, Pixel 4 XL, and Pixel 4a phones, the Pixel Slate tablet, and the Pixelbook and Pixelbook Go laptops) running the YouTube Music app, the Google Play Music app, the YouTube app, the Google Home app, and/or other native or web-based Chromecast-enabled app is an example of a "Chromecast-enabled computing device."

	Hub media player includes a tangible, non-transitory computer-readable storage medium comprising instructions that, when executed by a Hub media player's processor, cause that Hub media player to perform the functions identified below. *See, e.g.,* https://store.google.com/us/product/google_home_max?hl=en-US.
causing a graphical interface to display a control interface including one or more transport controls to control playback by the control device;	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause its graphical interface to display a control interface including one or more transport controls to control playback by the Chromecast-enabled computing device. For instance, each Chromecast-enabled computing device is programmed with the capability to cause its graphical interface to display a control interface having one or more transport controls that, at times, are configured to control the Chromecast-enabled computing device's playback of multimedia content from a streaming content service, among other media sources. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084 ("You can even use your mobile device or tablet as a remote and control everything from playback to volume."); https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en ("Using your phone or tablet: [ ] You can use the playback controls on the Google Play Music app . . . Using your computer: [ ] You can use the playback controls on Google Play Music, near the bottom of the screen."); https://support.google.com/chromecast/answer/2995235?hl=en-AU; https://support.google.com/googlenest/answer/7030379?co=GENIE.Platform%3DAndroid&hl=en-GB; https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Examples of this functionality are illustrated in the following screenshots from a Chromecast-enabled computing device running at least the YouTube Music, Google Play Music, and YouTube apps:

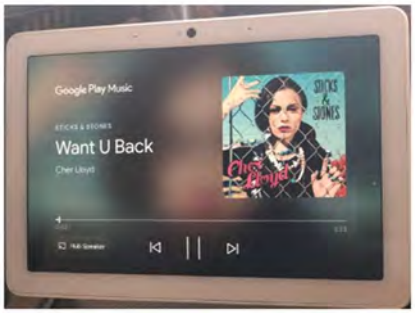
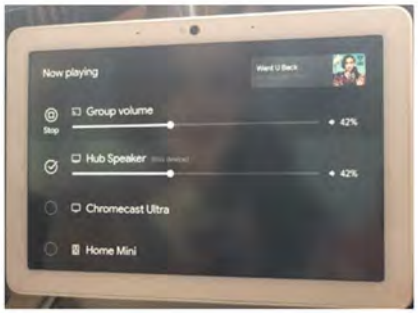




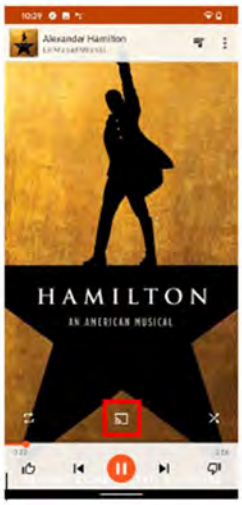


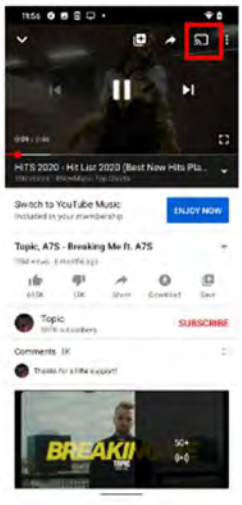
Likewise, each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause its graphical interface to display a control interface including one or more transport controls to control playback by the Hub media player.

For instance, each Hub media player is programmed with the capability to cause its graphical interface to display a control interface having one or more transport controls that, at times, are configured to control the Hub media player's playback of multimedia content from a streaming content service, among other media sources. *See, e.g.,* https://store.google.com/us/product/google_nest_hub?hl=en-US#overview-modal-music ("YouTube Music on demand. . . . Stream top music services."); https://store.google.com/us/product/google_nest_hub_max?hl=en-US ("jam out with YouTube Music."); https://support.google.com/googlenest/answer/9165738?hl=en-GB&ref_topic=7030084 ("With YouTube built-in to your Google Nest display, you can watch YouTube Originals, how-to videos and much more, seamlessly on your screen."). Examples of this functionality are illustrated in the following screenshots from a Hub media player running at least the YouTube Music, Google Play Music, and YouTube apps:

	   
after connecting to a local area network via a network interface, identifying playback devices connected to the local area network;	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause that Chromecast-enabled computing device to, after connecting to a local area network ("LAN") via a network interface, identify Chromecast-enabled media players connected to the LAN. For instance, each Chromecast-enabled computing device is programmed such that, after connecting to a LAN, the Chromecast-enabled computing device is configured to identify one or more Chromecast-enabled media players connected to that same LAN. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084 ("Make sure that your mobile device or tablet is connected to the same Wi-Fi network or linked to the same account as your Google Nest or Home speaker or display. . . . Tap the speaker or display for which you'd like to cast."); https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en ("Connect your phone or tablet and Chromecast to the same wireless network. . . . Select your Chromecast device from the device list."); https://support.google.com/chromecast/answer/2995235?hl=en-AU ("Make sure that your mobile device or computer is connected to the same Wi-Fi network as Chromecast. . . . Tap the Chromecast device to which you want to cast."); https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1("To show Chrome on your TV, you'll need . . . [t]o connect your computer and Chromecast device to the same Wi-Fi network.");

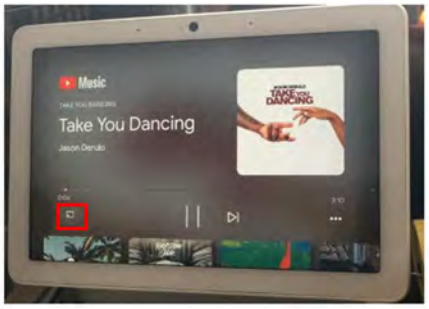
	https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Likewise, each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause that Hub media player to, after connecting to a LAN via a network interface, identify Chromecast-enabled media players connected to the LAN. For instance, each Hub media player is programmed such that, after connecting to a LAN, the Hub media player is configured to identify one or more Chromecast-enabled media players connected to that same LAN. *See, e.g.,*https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084 ("At the bottom-left corner of the screen, tap Devices to see the list of available devices and speaker groups.").
causing the graphical interface to display a selectable option for transferring playback from the control device;	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause its graphical interface to display a selectable option for transferring playback from the Chromecast-enabled computing device. For instance, each Chromecast-enabled computing device is programmed with the capability to cause its graphical interface to display a selectable option (e.g., a selectable "Cast button") for transferring playback of multimedia content from the Chromecast-enabled computing device to another device (e.g., a Chromecast-enabled media player). *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084 ("Tap the Cast button . . . . Tap the speaker or display for which you'd like to cast."); https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en ("Tap the Cast button . . . . Select your Chromecast device from the device list."); https://support.google.com/chromecast/answer/2995235?hl=en-AU ("Tap the Cast button . . . . Tap the Chromecast device to which you want to cast."); https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1(" 2. At the top right, click More Cast. 3. Choose the Chromecast device where you want to watch the content."); https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Examples of this functionality are illustrated in the following screenshots from a Chromecast-enabled computing device running at least the YouTube Music, Google Play Music, and YouTube apps:

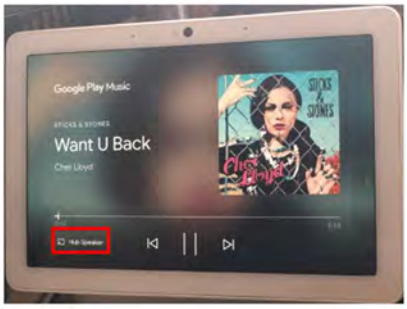


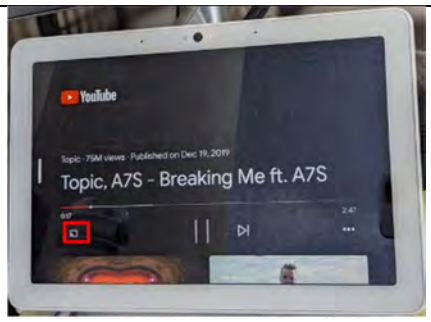


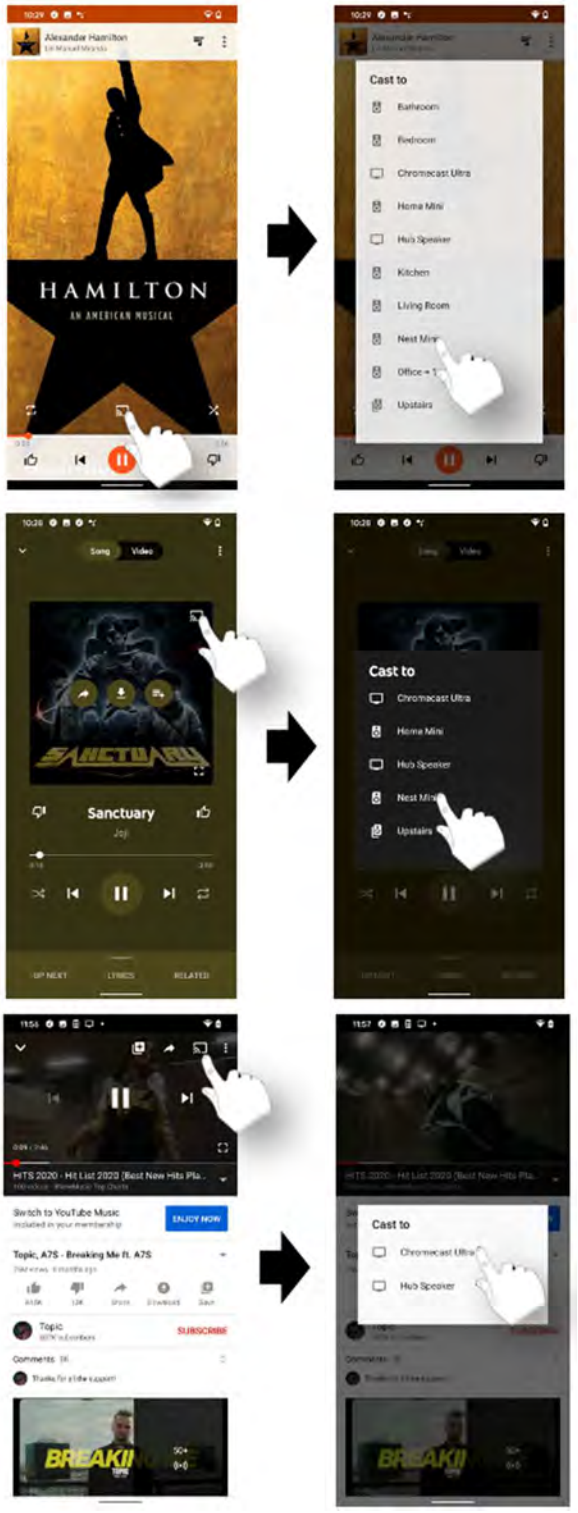
Likewise, each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause its graphical interface to display a selectable option for transferring playback from the Hub media player to another Chromecast-enabled media player.

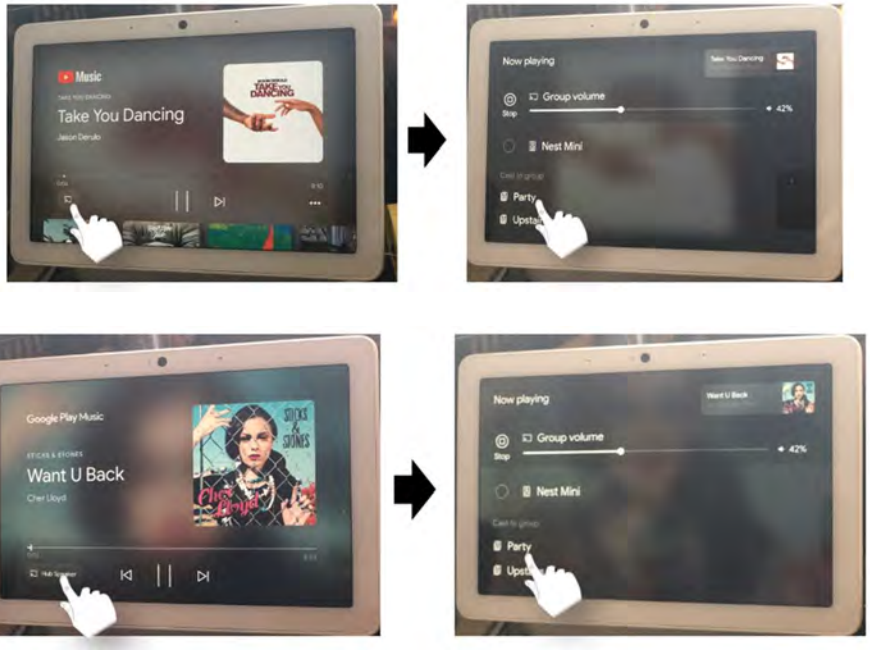
For instance, each Hub media player is programmed with the capability to cause its graphical interface to display a selectable option (e.g., a selectable "Cast button") for transferring playback of multimedia content from the Hub media player to another device (e.g., a Chromecast-enabled media player). *See, e.g.,* https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084 ("At the bottom-left corner of the screen, tap Devices to see the list of available devices and speaker groups. . . . Select the device for which you want to move your media."). Examples of this functionality are illustrated in the following screenshots from a Hub media player running at least the YouTube Music, Google Play Music, and YouTube apps:





	
detecting a set of inputs to transfer playback from the control device to a particular playback device, wherein the set of inputs comprises: (i) a selection of the selectable option for transferring playback from the control device and (ii) a selection of the particular playback device from the identified playback devices connected to the local area network:	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause that Chromecast-enabled computing device to detect a set of inputs to transfer playback from the Chromecast-enabled computing device to a particular Chromecast-enabled media player, where the set of inputs comprises: (i) a selection of the selectable option for transferring playback from the Chromecast-enabled computing device and (ii) a selection of the particular Chromecast-enabled media player from the identified Chromecast-enabled media players connected to the LAN. For instance, each Chromecast-enabled computing device is programmed with the capability to (i) detect a selection of a displayed selectable option (e.g., a selectable "Cast button") for transferring playback of multimedia content from the Chromecast-enabled computing device to another device, which triggers the Chromecast-enabled computing device to display a list of available devices for transferring playback that includes one or more identified Chromecast-enabled media players on the same LAN, and then (ii) detect a selection of at least one particular Chromecast-enabled media player connected to the same LAN. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084 ("Tap the Cast button . . . . Tap the speaker or display for which you'd like to cast."); https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en ("Tap the Cast button . . . . Select your Chromecast device from the device list."); https://support.google.com/chromecast/answer/2995235?hl=en-AU ("Tap the Cast button . . . . Tap the Chromecast device to which you want to cast."); https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1("2. At the top right, click More > Cast. 3. Choose the Chromecast device where you want to watch the content."); https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Examples of this functionality are illustrated in the following screenshots from a Chromecast-enabled

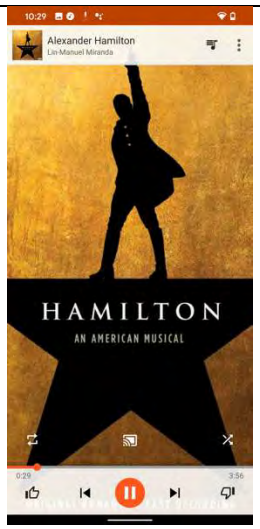
	computing device running at least the YouTube Music, Google Play Music, and YouTube apps: 

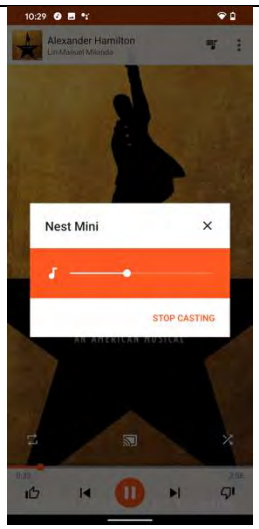
	Likewise each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause that Hub media player to detect a set of inputs to transfer playback from the Hub media player to a particular Chromecast-enabled media player, where the set of inputs comprises: (i) a selection of the selectable option for transferring playback from the Hub media player and (ii) a selection of the particular Chromecast-enabled media player from the identified Chromecast-enabled media players connected to the LAN. For instance, each Hub media player is programmed with the capability to (i) detect a selection of a displayed selectable option (e.g., a selectable "Cast button") for transferring playback of multimedia content from the Hub media player to another device, which triggers the Hub media player to display a list of available devices for transferring playback that includes one or more identified Chromecast-enabled media players on the same LAN, and then (ii) detect a selection of at least one particular Chromecast-enabled media player connected to the same LAN. *See, e.g.,* https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084 ("At the bottom-left corner of the screen, tap Devices to see the list of available devices and speaker groups. . . . Select the device for which you want to move your media."). Examples of this functionality are illustrated in the following screenshots from a Hub media player running at least the YouTube Music, Google Play Music, and YouTube apps: 

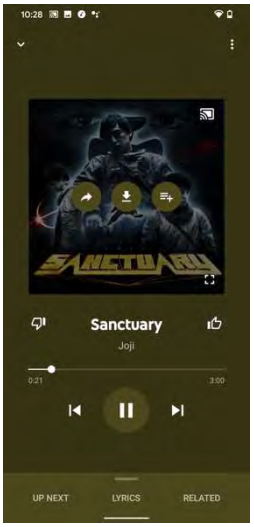
	
after detecting the set of inputs to transfer playback from the control device to the particular playback device, causing playback to be transferred from the control device to the particular playback device,	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause that Chromecast-enabled computing device to, after detecting the set of inputs to transfer playback from the Chromecast-enabled computing device to the particular Chromecast-enabled media player, cause playback to be transferred from the Chromecast-enabled computing device to the particular Chromecast-enabled media player. For instance, each Chromecast-enabled computing device is programmed such that, after detecting a set of inputs to transfer the Chromecast-enabled computing device's playback of multimedia content to at least one particular Chromecast-enabled media player, the Chromecast-enabled computing device causes the playback of the multimedia content to be transferred to the at least one particular Chromecast-enabled media player. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084 ("When you're connected, the Cast button will turn from light to dark grey, letting you know that you're connected."); https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1("To the right of the address bar, next to your extensions, you'll see Active cast ."); https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/2995235?hl=en-AU; https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Likewise, each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause that Hub media player to, after detecting the set of inputs to transfer playback from the Hub media player to the particular Chromecast-enabled media player, cause playback to be transferred from the Hub media player to the particular Chromecast-enabled media player. For instance, each Hub media player is programmed such that, after detecting a set of inputs to transfer the Hub media player's playback

	of multimedia content to at least one particular Chromecast-enabled media player, the Hub media player causes the playback of the multimedia content to be transferred to the at least one particular Chromecast-enabled media player. *See, e.g.,* https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084.
wherein transferring playback from the control device to the particular playback device comprises: (a) causing one or more first cloud servers to add multimedia content to a local playback queue on the particular playback device, wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service; (b) causing playback at the control device to be stopped; and (c) modifying the one or more transport controls of the control interface to control playback by the playback device; and	Each Chromecast-enabled computing device and each Hub media player is programmed such that transferring playback to the particular Chromecast-enabled media player comprises: (a) causing one or more first cloud servers to add multimedia content to a local playback queue on the particular Chromecast-enabled media player, where adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service, (b) causing playback at the Chromecast-enabled computing device (or Hub media player) to be stopped, and (c) modifying the one or more transport controls of the control interface to control playback by the Chromecast-enabled media player. For instance, on information and belief, each Chromecast-enabled computing device and each Hub media player is programmed such that, after detecting a set of inputs to transfer playback of multimedia content from a streaming content service (e.g., Google Play Music, YouTube Music, YouTube, etc.) to at least one particular Chromecast-enabled media player, the respective control device functions to (a) cause a first cloud server associated with the streaming content service (e.g., a first Google cloud server) to add resource locators for such multimedia content to a local playback queue of the particular Chromecast-enabled media player, where the resource locators correspond to locations of the multimedia content at a second cloud server associated with the streaming content service (e.g., a second Google cloud server), (b) stop its own playback of the multimedia content from the streaming content service, and (c) modify one or more transport controls of its control interface such that the one or more transport controls function to control playback by the at least one particular Chromecast-enabled media player rather than playback by the Chromecast-enabled computing device. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/2995235?hl=en-AU; https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084;

	https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1.
causing the particular playback device to play back the multimedia content, wherein the particular playback device playing back the multimedia content comprises the particular playback device retrieving the multimedia content from one or more second cloud servers of a streaming content service and playing back the retrieved multimedia content.	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause the particular Chromecast-enabled media player to play back the multimedia content, where the particular Chromecast-enabled media player playing back the multimedia content comprises the particular Chromecast-enabled media player retrieving the multimedia content from one or more second cloud servers of a streaming content service and playing back the retrieved multimedia content. For instance, on information and belief, each Chromecast-enabled computing device is programmed such that, after causing the Chromecast-enabled computing device's playback of multimedia content from a streaming content service (e.g., Google Play Music, YouTube Music, YouTube, etc.) to be transferred to at least one particular Chromecast-enabled media player, the Chromecast-enabled computing device causes the at least one particular Chromecast-enabled media player to play back the multimedia content from the streaming content service, which involves the particular Chromecast-enabled media player retrieving the multimedia content from the second cloud server associated with the streaming music service (e.g., the Google cloud server) and then playing back the retrieved multimedia content. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/2995235?hl=en-AU; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1; https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Examples of this functionality are illustrated in the following screenshots from a Chromecast-enabled computing device running at least the YouTube Music, Google Play Music, and YouTube apps:

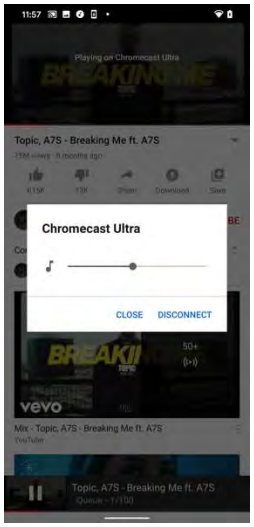

Alexander Hamilton
Lin-Manuel Miranda
HAMILTON
AN AMERICAN MUSICAL

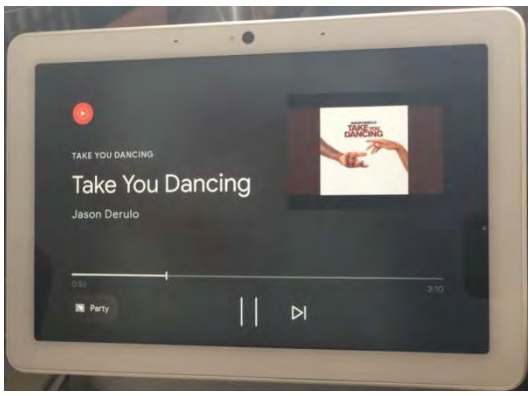

Alexander Hamilton
Nest Mini
STOP CASTING

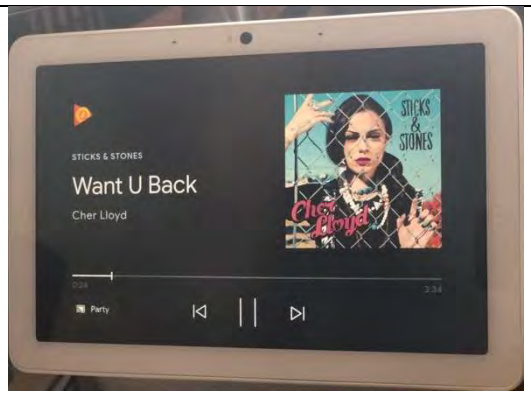
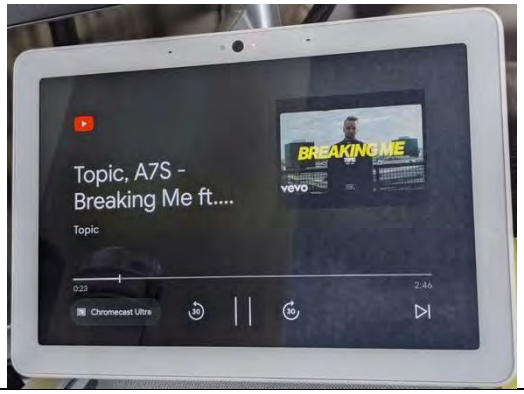

Sanctuary
Joji
UP NEXT
LYRICS
RELATED


Nest Mini
Sanctuary
Joji
STOP CASTING


Topic, A7S - Breaking Me ft. A7S
Topic
SUBSCRIBE
Comments 8K
Thanks for all the support!
Mix - Topic, A7S - Breaking Me ft. A7S
Topic, A7S - Breaking Me ft. A7S


Topic, A7S - Breaking Me ft. A7S
Chromecast Ultra
CLOSE
DISCONNECT
Topic, A7S - Breaking Me ft. A7S

	Likewise each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause the particular Chromecast-enabled media player to play back the multimedia content, where the particular Chromecast-enabled media player playing back the multimedia content comprises the particular Chromecast-enabled media player retrieving the multimedia content from one or more second cloud servers of a streaming content service and playing back the retrieved multimedia content. For instance, on information and belief, each Hub media player is programmed such that, after causing the Hub media player's playback of multimedia content from a streaming content service (e.g., Google Play Music, YouTube Music, YouTube, etc.) to be transferred to at least one particular Chromecast-enabled media player, the Hub media player causes the at least oen particular Chromecast-enabled media player to play back the multimedia content from the streaming content service, which involves the particular Chromecast-enabled media player retrieving the multimedia content from the second cloud server associated with the streaming music service (e.g., the second Google cloud server) and then playing back the retrieved multimedia content. *See, e.g.,* https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084. Examples of this functionality are illustrated in the following screenshots from a Hub media player running at least the YouTube Music, Google Play Music, and YouTube apps: 

83. On September 28, 2020, Sonos provided Google with a draft of this complaint prior to its filing. That draft identified the '615 Patent and described how Google's products infringed. Thus, Google had actual knowledge of Sonos's allegation that Google infringed claims of the '615 Patent prior to Sonos filing the complaint in this action.

84. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '615 Patent, in violation of 35 U.S.C. § 271(b), by actively inducing users of the Google Wireless Audio System to directly infringe the one or more claims of the '615 Patent. In particular, (a) Google had actual knowledge of the '615 Patent or was willfully blind to its existence prior to, and no later than, February 2019 and had actual knowledge or was willfully blind to Sonos's infringement allegations at least as early as September 28, 2020 when Sonos provided Google a copy of the complaint (*see* ¶¶ 19-29, above), (b) Google intentionally causes, urges, or encourages users of the Google Wireless Audio System to directly infringe one or more claims of the '615 Patent by promoting, advertising, and instructing customers and potential customers about the Google Wireless Audio System

(including uses thereof) and encouraging such customers and potential customers to engage in activity that constitutes direct infringement (*see* Exs. 22-27; *see also* citations above in the exemplary infringement claim chart for claim 13 of the '615 Patent), (c) Google knows (or should know) that its actions will induce users of the Google Wireless Audio System to directly infringe one or more claims the '615 Patent, and (d) users of the Google Wireless Audio System directly infringe one or more claims of the '615 Patent. For instance, at a minimum, Google has supplied and continues to supply the YouTube Music, Google Play Music, and YouTube apps to customers while knowing that installation and/or use of one or more of these apps will infringe one or more claims of the '615 Patent, and that Google's customers then directly infringe one or more claims of the '615 Patent by installing and/or using one or more of the these apps in accordance with Google's product literature. *See*, *e.g.*, *id*.

85. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '615 Patent, in violation of 35 U.S.C. § 271(c), by offering to sell or selling within the United States, and/or importing into the United States, components in connection with the Google Wireless Audio System that contribute to the direct infringement of the '615 Patent by users of the Google Wireless Audio System. In particular, (a) Google had actual knowledge of the '615 Patent or was willfully blind to its existence prior to, and no later than, February 2019 and had actual knowledge or was willfully blind to Sonos's infringement allegations at least as early as September 28, 2020 when Sonos provided Google a copy of the complaint (*see* ¶¶ 19-29 above), (b) Google offers for sale, sells, and/or imports, in connection with the Google Wireless Audio System, one or more material components of the invention of the '615 Patent that are not staple articles of commerce suitable for substantial noninfringing use, (c) Google knows (or should know) that such component(s) were especially made or especially adapted for use in an infringement of the '615 Patent, and (d) users of devices that comprise such material component(s) directly infringe one or more claims of the '615 Patent. For instance, at a minimum, Google offers for sale, sells, and/or imports the YouTube Music, Google Play Music, and YouTube apps for installation on devices (*e.g.*, smartphones, tablets, and

computers) that meet one or more claims of the '615 Patent. *See, e.g.*, Exs. 22-27. These apps are a material component of the devices that meet the one or more claims of the '615 Patent. Further, Google especially made and/or adapted these apps for installation and use on devices that meet the one or more claims of the '615 Patent, and these apps are not a staple article of commerce suitable for substantial noninfringing use. Google's customers then directly infringe the one or more claims of the '615 Patent by installing and/or using these apps on the customers' devices.

86. Google's infringement of the '615 Patent is also willful because Google (a) had actual knowledge of the '615 Patent no later than February 2019 and actual notice of Sonos's infringement contentions no later than September 28, 2020 (*see* ¶¶ 19-29 above), (b) engaged in the aforementioned activity despite an objectively high likelihood that Google's actions constituted infringement of the '615 Patent, and (c) this objectively-defined risk was either known or so obvious that it should have been known to Google.

87. Additional allegations regarding Google's pre-suit knowledge of the '615 Patent and willful infringement will likely have evidentiary support after a reasonable opportunity for discovery.

88. Sonos is entitled to recover from Google all damages that Sonos has sustained as a result of Google's infringement of the '615 Patent, including, without limitation, a reasonable royalty and lost profits.

89. Google's infringement of the '615 Patent was and continues to be willful and deliberate, entitling Sonos to enhanced damages.

90. Google's infringement of the '615 Patent is exceptional and entitles Sonos to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

91. Google's infringement of the '615 Patent has caused irreparable harm (including the loss of market share) to Sonos and will continue to do so unless enjoined by this Court.

COUNT II: INFRINGEMENT OF U.S. PATENT NO. 10,779,033

92. Sonos incorporates by reference and re-alleges paragraphs 1-79 of this Complaint as if fully set forth herein.

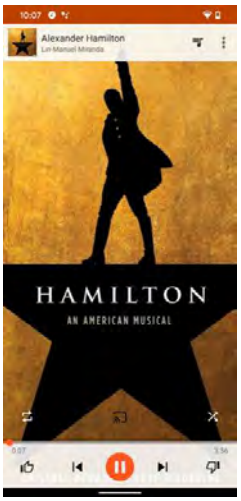
93. Google and/or users of the Google Wireless Audio System have directly infringed (either literally or under the doctrine of equivalents) and continue to directly infringe one or more of the claims of the '033 Patent, in violation of 35 U.S.C. § 271(a), by making, using, offering for sale, and/or selling the Google Wireless Audio System within the United States and/or importing the Google Wireless Audio System into the United States without authority or license.

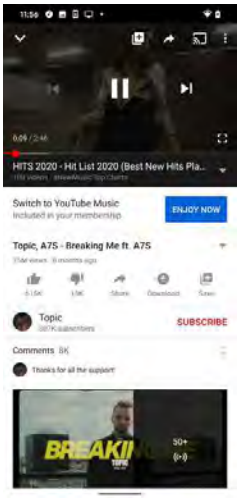
94. As just one non-limiting example, set forth below is an exemplary infringement claim chart for claim 1 of the '033 Patent in connection with the Google Wireless Audio System. This claim chart is based on publicly available information. Sonos reserves the right to modify this claim chart, including, for example, on the basis of information about the Google Wireless Audio System that it obtains during discovery.

Claim: 1	**Chromecast-Enabled Computing Devices**
A computing device comprising:	At least each smartphone, tablet, and computer running the YouTube Music app, the Google Play Music app, the YouTube app, and/or other native or web-based Chromecast-enabled apps (where a computing device installed with at least one of these Chromecast-enabled apps is referred to herein as a "Chromecast-enabled computing device") comprises a "computing device," as recited in claim 1. At least each Home Mini, Nest Mini, Home, Home Max, Home Hub, Nest Hub, Nest Hub Max, Nest Wifi Point, Chromecast, Chromecast Audio, Chromecast Ultra, Chromecast with Google TV, and Nest Audio ("Chromecast-enabled media player") is a data network device configured to process and output audio, and thus, comprises a "playback device" as recited in claim 13. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs; https://store.google.com/us/product/google_home_max?hl=en-US; https://store.google.com/us/product/google_home_max_partners?hl=en-US; https://store.google.com/product/chromecast_apps?utm_source=chromecast.com. In addition to being a "playback device" as recited in claim 1, each Home Hub, Nest Hub, and Nest Hub Max (referred to herein as a "Hub media player") is installed with Home/Nest Hub controller

	software such that the given Hub media player also comprises a "computing device," as recited in claim 1. *See, e.g.,* https://store.google.com/us/product/google_nest_hub?hl=en-US#overview-modal-music; https://store.google.com/us/product/google_nest_hub_max?hl=en-US; https://support.google.com/googlenest/answer/9165738?hl=en-GB&ref_topic=7030084.
at least one processor;	Each Chromecast-enabled computing device and each Hub media player includes at least one processor. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs; https://store.google.com/us/product/google_home_max?hl=en-US.
a non-transitory computer-readable medium; and	Each Chromecast-enabled computing device and each Hub media player includes a non-transitory computer-readable medium. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs; https://store.google.com/us/product/google_home_max?hl=en-US.
program instructions stored on the non-transitory computer-readable medium that, when executed by the at least one processor, cause the computing device to perform functions comprising:	Each Chromecast-enabled computing device and each Hub media player includes program instructions stored on the non-transitory computer-readable medium that enable the respective device to perform the functions identified below. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs; https://store.google.com/us/product/google_home_max?hl=en-US.
operating in a first mode in which the computing device is configured for playback of a remote playback queue provided by a cloud-based computing system associated with a cloud-based media service;	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause the Chromecast-enabled computing device to operate in a first mode in which the Chromecast-enabled computing device is configured for playback of a remote playback queue provided by a cloud-based computing system associated with a cloud-based media service. For instance, each Chromecast-enabled computing device is programmed with the capability to operate in a mode in which the Chromecast-enabled computing device is configured for playback of a remote playback queue provided by a Google cloud server associated with a cloud-based media service (e.g., Google Play Music, YouTube Music, YouTube, etc.). *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/6178107?co=GENIE.P

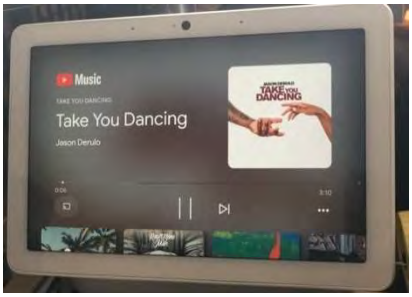
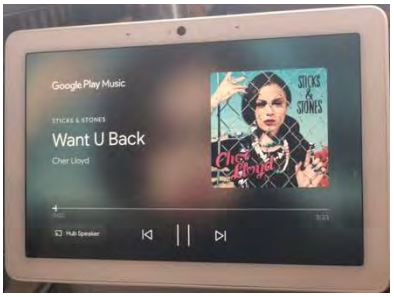
latform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/2995235?hl=en-AU; https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1; https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Examples of this functionality are illustrated in the following screenshots from a Chromecast-enabled computing device running at least the YouTube Music, Google Play Music, and YouTube apps:

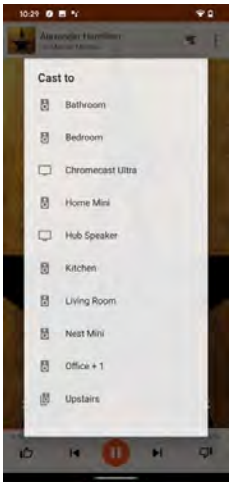
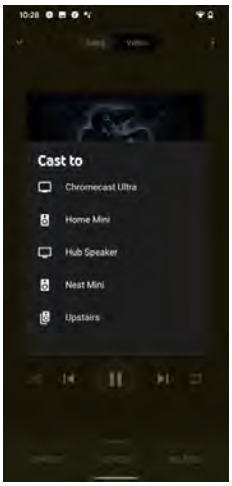
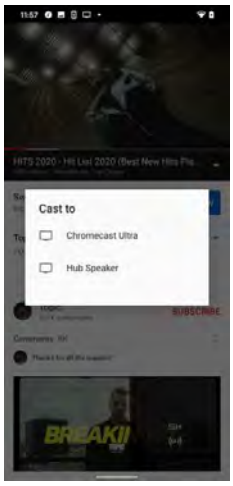


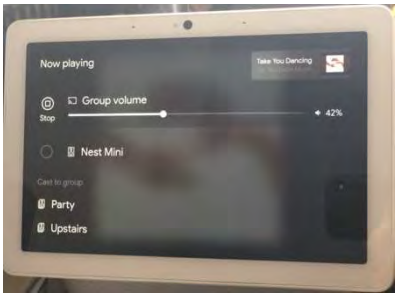
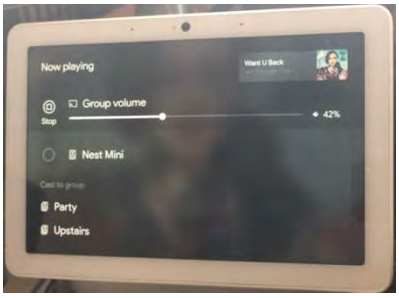


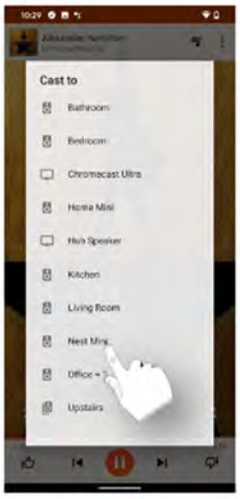
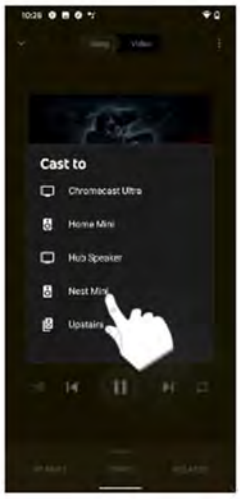
Likewise, each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause the Hub media player to operate in a first mode in which the Hub media player is configured for playback of a remote playback queue provided by a cloud-based computing system associated with a cloud-based media service.

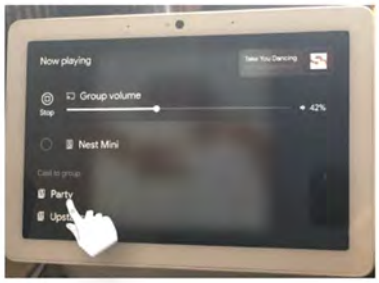
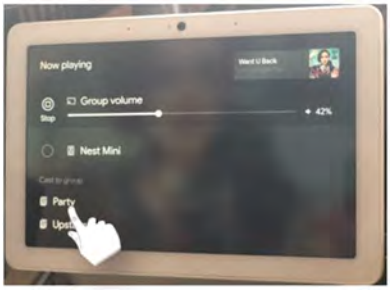
For instance, each Hub media player is programmed with the capability to operate in a mode in which the Hub media player is configured for playback of a remote playback queue provided by a Google cloud server associated with a cloud-based media service (e.g., Google Play Music, YouTube Music, YouTube, etc.). *See, e.g.,* https://store.google.com/us/product/google_nest_hub?hl=en-US#overview-modal-music ("YouTube Music on demand. . . . Stream top music services."); https://store.google.com/us/product/google_nest_hub_max?hl=en-US ("jam out with YouTube Music."); https://support.google.com/googlenest/answer/9165738?hl=en-GB&ref_topic=7030084 ("With YouTube built-in to your Google Nest display, you can watch YouTube Originals, how-to videos and

	much more, seamlessly on your screen."). Examples of this functionality are illustrated in the following screenshots from a Hub media player running at least the YouTube Music, Google Play Music, and YouTube apps:   
while operating in the first mode, displaying a representation of one or more playback devices in a media playback system that are each i) communicatively coupled to the computing device over a data network and ii) available to accept playback responsibility for the remote playback queue;	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause the Chromecast-enabled computing device to, while operating in the first mode, display a representation of one or more Chromecast-enabled media players in a Chromecast-enabled playback system that are each (i) communicatively coupled to the Chromecast-enabled computing device over a data network and (ii) available to accept playback responsibility for the remote playback queue. For instance, each Chromecast-enabled computing device is programmed such that, while operating in a mode in which the Chromecast-enabled computing device is configured for playback of a remote playback queue provided by a Google cloud server associated with a cloud-based media service (e.g., Google Play Music, YouTube Music, YouTube, etc.), the Chromecast-enabled computing device is operable to detect a selection of a displayed selectable option (e.g., a selectable "Cast button") for transferring playback of multimedia content from the Chromecast-enabled computing device to another device, which triggers the Chromecast-enabled computing device to display a list of available devices for transferring playback that includes one or more Chromecast-enabled media players in a Chromecast-enabled playback system that are each (i) communicatively coupled to the Chromecast-enabled computing device over a local area network ("LAN") and (ii) available to accept

	playback responsibility for the remote playback queue. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084 ("Tap the Cast button . . . . Tap the speaker or display for which you'd like to cast."); https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en ("Tap the Cast button . . . . Select your Chromecast device from the device list."); https://support.google.com/chromecast/answer/2995235?hl=en-AU ("Tap the Cast button . . . . Tap the Chromecast device to which you want to cast."); https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1(" 2. At the top right, click More Cast. 3. Choose the Chromecast device where you want to watch the content."); https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Examples of this functionality are illustrated in the following screenshots from a Chromecast-enabled computing device running at least the YouTube Music, Google Play Music, and YouTube apps:    Likewise, each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause the Hub media player to, while operating in the first mode, display a representation of one or more Chromecast-enabled media players in a Chromecast-enabled playback system that are each (i) communicatively coupled to the Hub media player over a data network and (ii) available to accept playback responsibility for the remote playback queue. For instance, each Hub media player is programmed such that, while operating in a mode in which the Hub media player is configured for playback of a remote playback queue provided by a Google cloud-based computing system associated with a cloud-based media service

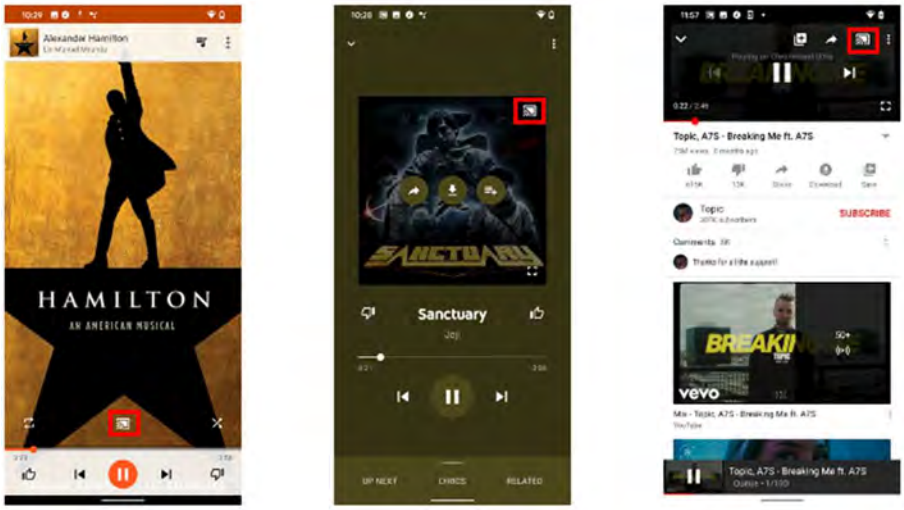
	(e.g., Google Play Music, YouTube Music, YouTube, etc.), the Hub media player is operable to detect a selection of a displayed selectable option (e.g., a selectable "Cast button") for transferring playback of multimedia content from the Hub media player to another device, which triggers the Hub media player to display a list of available devices for transferring playback that includes one or more other Chromecast-enabled media players in a Chromecast-enabled playback system that are each (i) communicatively coupled to the Hub media player over a LAN and (ii) available to accept playback responsibility for the remote playback queue. *See, e.g.,* https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084 ("At the bottom-left corner of the screen, tap Devices to see the list of available devices and speaker groups. . . . Select the device for which you want to move your media."). Examples of this functionality are illustrated in the following screenshots from a Hub media player running at least the YouTube Music, Google Play Music, and YouTube apps:   
while displaying the representation of the one or more playback devices, receiving user input indicating a selection of at least one given playback device from the one or more playback devices;	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause the Chromecast-enabled computing device to, while displaying the representation of the one or more Chromecast-enabled media players, receive user input indicating a selection of at least one given Chromecast-enabled media player from the one or more Chromecast-enabled media players. For instance, each Chromecast-enabled computing device is programmed such that, while displaying the representation of the one or more Chromecast-enabled media players in a Chromecast-enabled playback system that are each on the same LAN as the Chromecast-

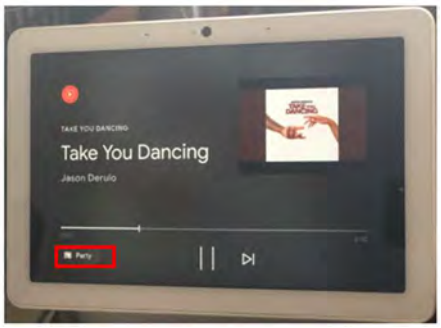
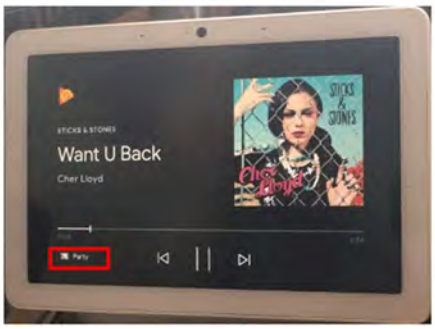
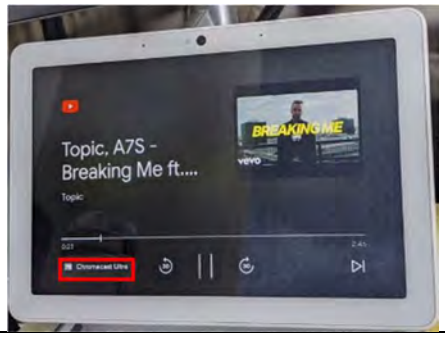
	enabled computing device and available to accept playback responsibility for the remote playback queue, the Chromecast-enabled computing device is configured to receive user input indicating a selection of at least one Chromecast-enabled media player in the Chromecast-enabled playback system. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084 ("Tap the speaker or display for which you'd like to cast."); https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en ("Select your Chromecast device from the device list."); https://support.google.com/chromecast/answer/2995235?hl=en-AU ("Tap the Chromecast device to which you want to cast."); https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1("Choose the Chromecast device where you want to watch the content."). Examples of this functionality are illustrated in the following screenshots from a Chromecast-enabled computing device running at least the YouTube Music, Google Play Music, and YouTube apps:    Likewise each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause the Hub media player to, while displaying the representation of the one or more Chromecast-enabled media players, receive user input indicating a selection of at least one given Chromecast-enabled media player from the one or more Chromecast-enabled media players. For instance, each Hub media player is programmed such that, while displaying the representation of the one or more other Chromecast-enabled media players in a Chromecast-enabled playback system that are each on the same LAN as the Hub media player and available to

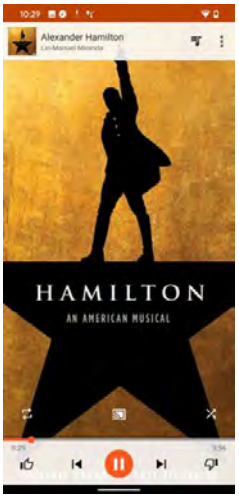
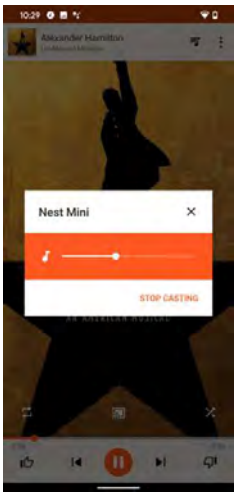
	accept playback responsibility for the remote playback queue, the Hub media player is configured to receive user input indicating a selection of at least one other Chromecast-enabled media player in the Chromecast-enabled playback system. *See, e.g.,* https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084 ("Select the device for which you want to move your media."). Examples of this functionality are illustrated in the following screenshots from a Hub media player:   
based on receiving the user input, transmitting an instruction for the at least one given playback device to take over responsibility for playback of the remote playback queue from the	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause the Chromecast-enabled computing device to, based on receiving the user input, transmit an instruction for the at least one given Chromecast-enabled media player to take over responsibility for playback of the remote playback queue from the Chromecast-enabled computing device, wherein the instruction configures the at least one given Chromecast-enabled media player to (i) communicate with the Google cloud-based computing system in order to obtain data identifying a next one or more media items that are in the remote playback queue, (ii) use the obtained data to retrieve at least one

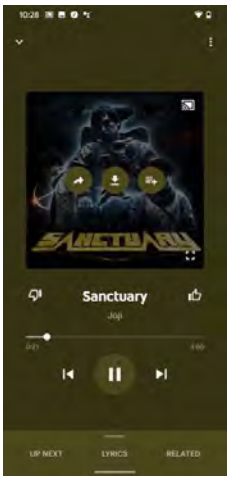
computing device, wherein the instruction configures the at least one given playback device to (i) communicate with the cloud-based computing system in order to obtain data identifying a next one or more media items that are in the remote playback queue, (ii) use the obtained data to retrieve at least one media item in the remote playback queue from the cloud-based media service; and (iii) play back the retrieved at least one media item;	media item in the remote playback queue from the Google cloud-based media service; and (iii) play back the retrieved at least one media item. For instance, on information and belief, each Chromecast-enabled computing device is programmed such that, based on receiving the user input indicating a selection of at least one Chromecast-enabled media player in the Chromecast-enabled playback system that is on the same LAN as the Chromecast-enabled computing device and available to accept playback responsibility for the remote playback queue, the Chromecast-enabled computing device is configured to transmit an instruction for the Chromecast-enabled media player to take over responsibility for playback of the remote playback queue from the Chromecast-enabled computing device, where the instruction configures the Chromecast-enabled media player to (i) communicate with a Google cloud server associated with a Google cloud-based media service (e.g., Google Play Music, YouTube Music, YouTube, etc.) in order to obtain data identifying a next one or more media items that are in the remote playback queue (e.g., resource locators for such media items), (ii) use the obtained data to retrieve at least one media item in the remote playback queue from the Google cloud-based media service; and (iii) play back the retrieved at least one media item. *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/2995235?hl=en-AU; https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1. Likewise each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause the Hub media player to, based on receiving the user input, transmit an instruction for the at least one given Chromecast-enabled media player to take over responsibility for playback of the remote playback queue from the Hub media player, wherein the instruction configures the at least one given Chromecast-enabled media player to (i) communicate with the Google cloud-based computing system in order to obtain data identifying a next one or more media items that are in the remote playback queue, (ii) use the obtained data to retrieve at least one media item in the remote playback queue from the Google cloud-based media service; and (iii) play back the retrieved at least one media item.

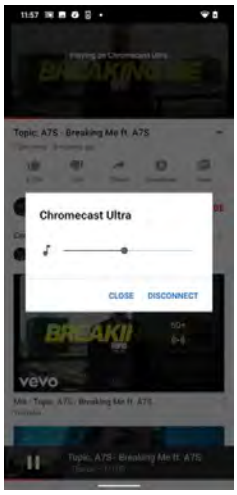
	For instance, on information and belief, each Hub media player is programmed such that, based on receiving the user input indicating a selection of at least one other Chromecast-enabled media player in the Chromecast-enabled playback system that is on the same LAN as the Hub media player and available to accept playback responsibility for the remote playback queue, the Hub media player is configured to transmit an instruction for the other Chromecast-enabled media player to take over responsibility for playback of the remote playback queue from the Hub media player, where the instruction configures the other Chromecast-enabled media player to (i) communicate with a Google cloud server associated with a Google cloud-based media service (e.g., Google Play Music, YouTube Music, YouTube, etc.) in order to obtain data identifying a next one or more media items that are in the remote playback queue (e.g., resource locators for such media items), (ii) use the obtained data to retrieve at least one media item in the remote playback queue from the Google cloud-based media service; and (iii) play back the retrieved at least one media item. *See, e.g., id.*
detecting an indication that playback responsibility for the remote playback queue has been successfully transferred from the computing device to the at least one given playback device; and	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause the Chromecast-enabled computing device to detect an indication that playback responsibility for the remote playback queue has been successfully transferred from the Chromecast-enabled computing device to the at least one given Chromecast-enabled media player. For instance, each Chromecast-enabled computing device is programmed with the capability to detect an indication that playback responsibility for the remote playback queue has been successfully transferred from the Chromecast-enabled computing device to at least one Chromecast-enabled media player, which is demonstrated by the fact that the Chromecast-enabled computing device displays an indicator that playback responsibility for the remote playback queue has been successfully transferred to the at least one Chromecast-enabled media player that takes the form of a "Cast button" that is "filled in" and/or "dark grey." *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084 ("When you're connected, the Cast button will turn from light to dark grey, letting you know that you're connected."); https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1("To the right of the address bar, next to your extensions, you'll see Active cast ."); https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en;

	https://support.google.com/chromecast/answer/2995235?hl=en-AU; https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Examples of a Chromecast-enabled computing device detecting an indication that playback responsibility for the remote playback queue has been successfully transferred from the Chromecast-enabled computing device to at least one Chromecast-enabled media player are illustrated in the following screenshots from a Chromecast-enabled computing device running at least the YouTube Music, Google Play Music, and YouTube apps:  Likewise, each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause the Hub media player to detect an indication that playback responsibility for the remote playback queue has been successfully transferred from the Hub media player to the at least one given Chromecast-enabled media player. For instance, each Hub media player is programmed with the capability to detect an indication that playback responsibility for the remote playback queue has been successfully transferred from the Hub media player to at least one other Chromecast-enabled media player, which is demonstrated by the fact that the Chromecast-enabled computing device displays an indicator that playback responsibility for the remote playback queue has been successfully transferred to the at least one other Chromecast-enabled media player that takes the form of a "Cast button" that is "filled in" and/or has a "dark grey" color along with a display of the other Chromecast-enabled media player's name. *See, e.g.,* https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084. Examples of a selectable "Cast button" having this second visual appearance are illustrated in the following

	screenshots from a Hub media player running at least the YouTube Music, Google Play Music, and YouTube apps:   
after detecting the indication, transitioning from i) the first mode in which the computing device is configured for playback of the remote playback queue to ii) a second mode in which the computing device is configured to control the at least one given playback device's playback of the	Each Chromecast-enabled computing device comprises instructions that, when executed by a Chromecast-enabled computing device's processor, cause the Chromecast-enabled computing device to, after detecting the indication, transition from (i) the first mode in which the Chromecast-enabled computing device is configured for playback of the remote playback queue to (ii) a second mode in which the Chromecast-enabled computing device is configured to control the at least one given Chromecast audio player's playback of the remote playback queue and the Chromecast-enabled computing device is no longer configured for playback of the remote playback queue. For instance, each Chromecast-enabled computing device is programmed such that, after detecting the indication that playback responsibility for the remote playback queue has been successfully transferred from the Chromecast-enabled computing device to at least

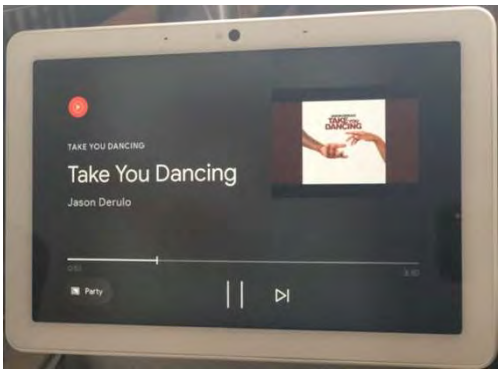
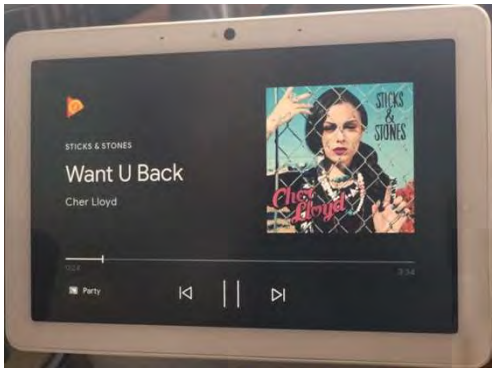
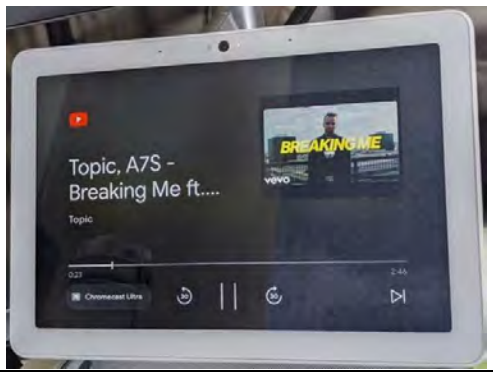
remote playback queue and the computing device is no longer configured for playback of the remote playback queue.	one Chromecast-enabled media player in the Chromecast-enabled playback system that is on the same LAN as the Chromecast-enabled computing device, the Chromecast-enabled computing device is configured to transition from (i) the first mode in which the Chromecast-enabled computing device was configured for playback of the remote playback queue to (ii) a second mode in which the Chromecast-enabled computing device is configured to control the at least one Chromecast-enabled media player's playback of the remote playback queue (while the Chromecast-enabled computing device itself is no longer configured for playback of the remote playback queue). *See, e.g.,* https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/2995235?hl=en-AU; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1; https://support.google.com/chromecast/answer/3265953?hl=en-GB&ref_topic=4602553. Examples of a Chromecast-enabled computing device in this second mode are illustrated in the following screenshots from a Chromecast-enabled computing device running at least the YouTube Music, Google Play Music, and YouTube apps:  





Each Hub media player comprises instructions that, when executed by a Hub media player's processor, cause the Hub media player to, after detecting the indication, transition from (i) the first mode in which the Hub media player is configured for playback of the remote playback queue to (ii) a second mode in which the Hub media player is configured to control the at least one given Chromecast audio player's playback of the remote playback queue and the Hub media player is no longer configured for playback of the remote playback queue.

For instance, each Hub media player is programmed such that, after detecting the indication that playback responsibility for the remote playback queue has been successfully transferred from the Hub media player to at least one other Chromecast-enabled media player in the Chromecast-enabled playback system that is on the same LAN as the Hub media player, the Hub media player is configured to transition from (i) the first mode in which the Hub media player was configured for playback of the remote playback queue to (ii) a second mode in which the Hub media player is configured to control the at least one

	other Chromecast-enabled media player's playback of the remote playback queue (while the Hub media player itself is no longer configured for playback of the remote playback queue). *See, e.g.,* https://support.google.com/googlenest/answer/9563059?hl=en-GB&ref_topic=7030084. Examples of a Hub media player in this second mode are illustrated in the following screenshots from a Hub media player running at least the YouTube Music, Google Play Music, and YouTube apps:   

95. On September 28, 2020, Sonos provided Google with a draft of this complaint prior to its filing. That draft identified the '033 Patent and described how Google's products

infringed. Thus, Google had actual knowledge of Sonos's allegation that Google infringed claims of the '033 Patent prior to Sonos filing the complaint in this action.

96. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '033 Patent, in violation of 35 U.S.C. § 271(b), by actively inducing users of the Google Wireless Audio System to directly infringe the one or more claims of the '033 Patent. In particular, (a) Google had actual knowledge of the '033 Patent and Sonos's infringement contentions, or was willfully blind to their existence, no later than September 28, 2020 when Sonos provided Google with a copy of the complaint (*see* ¶¶ 19-29 above), (b) Google intentionally causes, urges, or encourages users of the Google Wireless Audio System to directly infringe one or more claims of the '033 Patent by promoting, advertising, and instructing customers and potential customers about the Google Wireless Audio System (including uses thereof) and encouraging such customers and potential customers to engage in activity that constitutes direct infringement (*see* Exs. 22-27; *see also* citations above in the exemplary infringement claim chart for claim 1 of the '033 Patent), (c) Google knows (or should know) that its actions will induce users of the Google Wireless Audio System to directly infringe one or more claims the '033 Patent, and (d) users of the Google Wireless Audio System directly infringe one or more claims of the '033 Patent. For instance, at a minimum, Google has supplied and continues to supply the YouTube Music, Google Play Music, and YouTube apps to customers while knowing that installation and/or use of one or more of these apps will infringe one or more claims of the '033 Patent, and that Google's customers then directly infringe one or more claims of the '033 Patent by installing and/or using one or more of these apps in accordance with Google's product literature. *See*, e.g., *id*.

97. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '033 Patent, in violation of 35 U.S.C. § 271(c), by offering to sell or selling within the United States, and/or importing into the United States, components in connection with the Google Wireless Audio System that contribute to the direct infringement of the '033 Patent by users of the Google Wireless Audio System. In particular,

(a) Google had actual knowledge of the '033 Patent and Sonos's infringement contentions, or was willfully blind to their existence, no later than September 28, 2020 when Sonos provided Google with a copy of the complaint (*see* ¶¶ 19-29 above), (b) Google offers for sale, sells, and/or imports, in connection with the Google Wireless Audio System, one or more material components of the invention of the '033 Patent that are not staple articles of commerce suitable for substantial noninfringing use, (c) Google knows (or should know) that such component(s) were especially made or especially adapted for use in an infringement of the '033 Patent, and (d) users of devices that comprise such material component(s) directly infringe one or more claims of the '033 Patent. For instance, at a minimum, Google offers for sale, sells, and/or imports the YouTube Music, Google Play Music, and YouTube apps for installation on devices (*e.g.*, smartphones, tablets, and computers) that meet one or more claims of the '033 Patent. *See, e.g.*, Exs. 22-27. These apps are a material component of the devices that meet the one or more claims of the '033 Patent. Further, Google especially made and/or adapted these apps for installation and use on devices that meet the one or more claims of the '033 Patent, and these apps are not a staple article of commerce suitable for substantial noninfringing use. Google's customers then directly infringe the one or more claims of the '033 Patent by installing and/or using these apps on the customers' devices.

98. Google's infringement of the '033 Patent is also willful because Google (a) had actual knowledge of the '033 Patent and Sonos's infringement contentions no later than September 28, 2020 (*see* ¶¶ 19-29 above), (b) engaged in the aforementioned activity despite an objectively high likelihood that Google's actions constituted infringement of the '033 Patent, and (c) this objectively-defined risk was either known or so obvious that it should have been known to Google.

99. Additional allegations regarding Google's pre-suit knowledge of the '033 Patent and willful infringement will likely have evidentiary support after a reasonable opportunity for discovery.

100. Sonos is entitled to recover from Google all damages that Sonos has sustained as a result of Google's infringement of the '033 Patent, including, without limitation, a reasonable royalty and lost profits.

101. Google's infringement of the '033 Patent was and continues to be willful and deliberate, entitling Sonos to enhanced damages.

102. Google's infringement of the '033 Patent is exceptional and entitles Sonos to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

103. Google's infringement of the '033 Patent has caused irreparable harm (including the loss of market share) to Sonos and will continue to do so unless enjoined by this Court.

COUNT III: INFRINGEMENT OF U.S. PATENT NO. 9,344,206

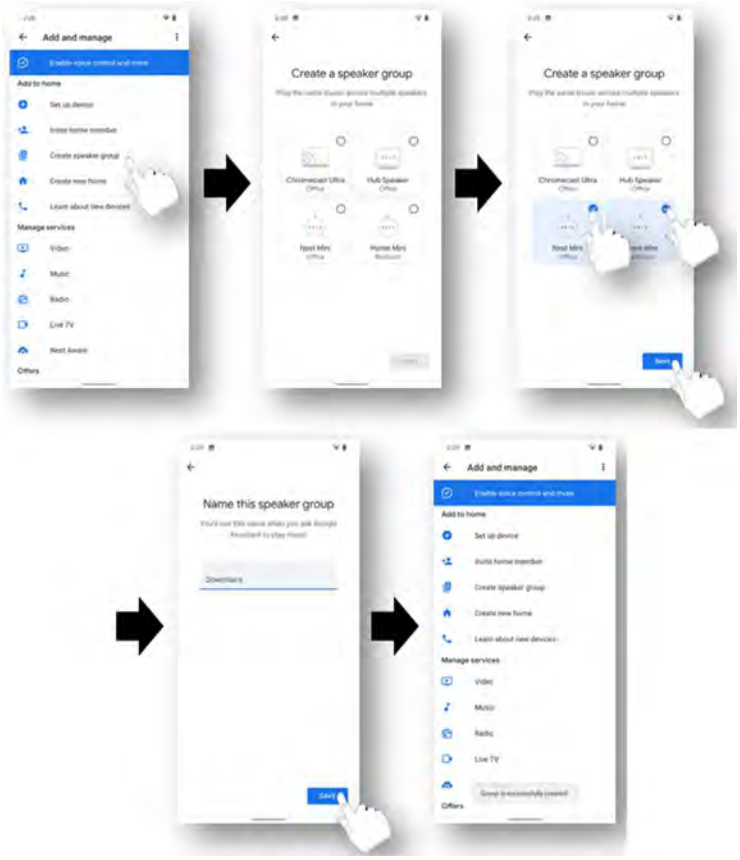
104. Sonos incorporates by reference and re-alleges paragraphs 1-79 of this Complaint as if fully set forth herein.

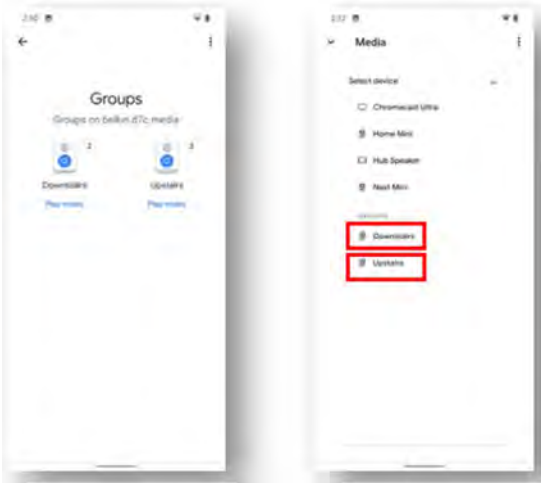
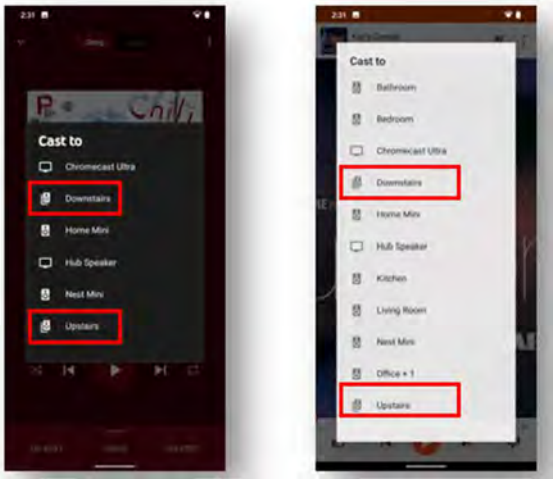
105. Google and/or users of the Google Wireless Audio System have directly infringed (either literally or under the doctrine of equivalents) and continue to directly infringe one or more of the claims of the '206 Patent, in violation of 35 U.S.C. § 271(a), by making, using, offering for sale, and/or selling the Google Wireless Audio System within the United States and/or importing the Google Wireless Audio System into the United States without authority or license.

106. As just one non-limiting example, set forth below is an exemplary infringement claim chart for claim 1 of the '206 Patent in connection with the Google Wireless Audio System. This claim chart is based on publicly available information. Sonos reserves the right to modify this claim chart, including, for example, on the basis of information about the Google Wireless Audio System that it obtains during discovery.

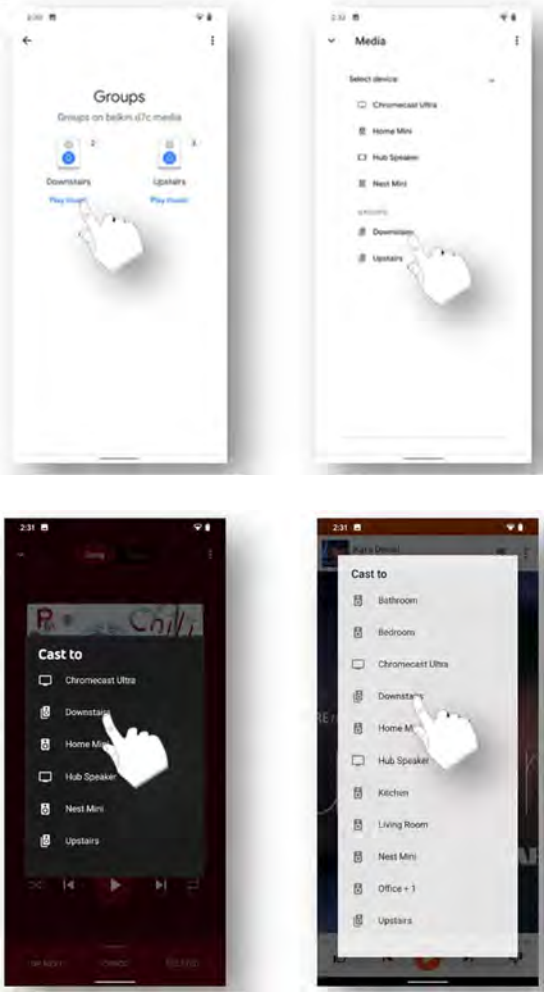
Claim: 1	Chromecast-Enabled Computing Devices
A multimedia controller including a processor, the controller configured to:	At least each smartphone, tablet, and computer installed with at least the Google Home app (where a computing device installed with at least the Google Home app is referred to herein as a "Chromecast-enabled computing device") comprises a "multimedia controller including a processor," as recited in claim 1. At least each Home Mini, Nest Mini, Home, Home Max, Home Hub, Nest Hub, Nest Hub

	Max, Nest Wifi Point, Chromecast, Chromecast Audio, Chromecast Ultra, Chromecast with Google TV, and Nest Audio ("Chromecast-enabled media player") is a data network device configured to process and output audio that is capable of playing multimedia separately from other Chromecast-enabled media players, and thus, comprises an "independent playback device" as recited in claim 1. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs; https://store.google.com/us/product/google_home_max?hl=en-US; https://store.google.com/us/product/google_home_max_partners?hl=en-US; https://play.google.com/store/apps/details?id=com.google.android.apps.chromecast.app&hl=en_US. In addition to being a "independent playback device" as recited in claim 1, each Home Hub, Nest Hub, and Nest Hub Max (referred to herein as a "Hub media player") is installed with Home/Nest Hub controller software such that the given Hub media player also comprises a "multimedia controller including a processor," as recited in claim 1. *See, e.g.,* https://store.google.com/us/product/google_nest_hub?hl=en-US#overview-modal-music; https://store.google.com/us/product/google_nest_hub_max?hl=en-US; https://support.google.com/googlenest/answer/9165738?hl=en-GB&ref_topic=7030084
receive, via a network interface, a zone configuration from a first independent playback device of a plurality of independent playback devices, wherein the zone configuration is configured via the controller and maintained at the first independent playback device, and wherein the zone configuration characterizes one or more zone scenes, each zone scene	Each Chromecast-enabled computing device is configured to receive, via a network interface, a zone configuration from a first Chromecast-enabled media player of a plurality of Chromecast-enabled media players, where the zone configuration is configured via the Chromecast-enabled computing device, maintained at the first Chromecast-enabled media player, and characterizes one or more zone scenes that each identify a group configuration associated with two or more of the plurality of Chromecast-enabled media players. For instance, each Chromecast-enabled computing device on a local area network ("LAN") is configured to facilitate creation of predefined "speaker group" comprising two or more Chromecast-enabled media players on the same LAN as the Chromecast-enabled computing device, which is "a zone scene identifying a particular group configuration." *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en (providing instructions on how to create "speaker groups"). One example of this functionality is illustrated by the following screenshots, which shows the creation of a predefined

identifying a group configuration associated with two or more of the plurality of independent playback devices; and	"Downstairs" "speaker group" that identifies a particular group configuration comprising the "Nest Mini" and "Home Mini" players:  Once the predefined "speaker group" identifying the particular group configuration has been created, a zone configuration characterizing this "speaker group" is maintained at one or more of the plurality Chromecast-enabled media players on the same LAN as the Chromecast-enabled computing device (e.g., one or more of the Chromecast-enabled media players included in the predefined "speaker group"). *See, e.g., id.* Thereafter, each Chromecast-enabled computing device and each Hub media player on the same LAN as the plurality of Chromecast-enabled media players is operable to receive the zone configuration characterizing the predefined "speaker group" from one or more of the plurality of Chromecast-enabled media players at various times – including in advance of a Chromecast-enabled computing device or Hub media player displaying the predefined "speaker group" as an available option for playback. *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/6178107?co=GENIE.

	Platform%3DAndroid&hl=en; https://support.google.com/googlenest/answer/7030379?co=GENIE.Platform%3DAndroid&hl=en-GB; https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1. Examples of this functionality are illustrated by the following screenshots from a Chromecast-enabled computing device installed with at least the Google Home, Google Play Music and YouTube Music apps, which show a Chromecast-enabled computing device that has received a zone configuration characterizing a "Downstairs" "speaker group" and a "Upstairs" "speaker group":   Notably, each Chromecast-enabled computing device and each Hub media player is programmed with the capability to display a predefined "speaker group" as an available option for playback regardless of whether the Chromecast-enabled computing device or

	Hub media player was used to create the predefined "speaker group" (and in fact, regardless of whether the Chromecast-enabled computing device or Hub media player was even powered up or on the same LAN as the plurality of Chromecast-enabled media players at the time that the "speaker group" was created), which demonstrates that each Chromecast-enabled computing device and each Hub media player receives a zone configuration characterizing a predefined "speaker group" from one or more of the Chromecast-enabled media players selected for inclusion in the "speaker group." *See e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en. In this regard, to facilitate the above functionality, each Chromecast-enabled computing device and each Hub media player is programmed with the capability to receive, from one of the plurality of Chromecast-enabled media players, a zone configuration characterizing one or more zone scenes that each identify a respective group configuration comprising two or more of the plurality of Chromecast-enabled media players.
cause a selectable indication of the received zone configuration to be displayed, wherein the displayed selectable indication is selectable to cause one or more of the zone scenes to be invoked by two or more of the plurality of independent playback devices.	Each Chromecast-enabled computing device is configured to cause a selectable indication of the received zone configuration to be displayed, where the displayed selectable indication is selectable to cause one or more of the zone scenes to be invoked by two or more of the plurality of Chromecast-enabled media players. For instance, as noted above, each Chromecast-enabled computing device is programmed with the capability to (i) receive a zone configuration characterizing one or more zone scenes that each identify a respective group configuration comprising two or more of the plurality of Chromecast-enabled media players (*e.g.*, one or more "speaker groups"), and (ii) cause an indication of the received zone configuration to be displayed that is selectable to cause a particular zone scene (*e.g.,* a "speaker group") to be invoked by two or more of the plurality of Chromecast-enabled media players. *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/googlenest/answer/7030379?co=GENIE.Platform%3DAndroid&hl=en-GB; https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1. Examples of this functionality are illustrated by the following screenshots from a Chromecast-enabled computing device running at

	least the Google Home, Google Play Music and YouTube Music apps, which show an indication of a received zone configuration characterizing a "Downstairs" "speaker group" that is selectable to cause the "Downstairs" "speaker group" to be invoked by the Chromecast-enabled media players included in the "Downstairs" "speaker group": 

107. On September 28, 2020, Sonos provided Google with a draft of this complaint prior to its filing. That draft identified the '206 Patent and described how Google's products infringed. Thus, Google had actual knowledge of Sonos's allegation that Google infringed claims of the '206 Patent prior to Sonos filing the complaint in this action.

108. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '206 Patent, in violation of 35 U.S.C. § 271(b),

by actively inducing users of the Google Wireless Audio System to directly infringe the one or more claims of the '206 Patent. In particular, (a) Google had actual knowledge of the '206 Patent or was willfully blind to its existence prior to, and no later than, October 2016 and had actual knowledge or was willfully blind to Sonos's infringement allegations at least as early as September 28, 2020 when Sonos provided Google a copy of the complaint(*see* ¶¶ 19-29 above), (b) Google intentionally causes, urges, or encourages users of the Google Wireless Audio System to directly infringe one or more claims of the '206 Patent by promoting, advertising, and instructing customers and potential customers about the Google Wireless Audio System (including uses thereof) and encouraging such customers and potential customers to engage in activity that constitutes direct infringement (*see* Exs. 22-23; *see also* citations above in the exemplary infringement claim chart for claim 1 of the '206 Patent), (c) Google knows (or should know) that its actions will induce users of the Google Wireless Audio System to directly infringe one or more claims the '206 Patent, and (d) users of the Google Wireless Audio System directly infringe one or more claims of the '206 Patent. For instance, at a minimum, Google has supplied and continues to supply the Google Home app to customers while knowing that installation and/or use of this app will infringe one or more claims of the '206 Patent, and that Google's customers then directly infringe one or more claims of the '206 Patent by installing and/or using this app in accordance with Google's product literature. *See*, e.g., *id*.

109. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '206 Patent, in violation of 35 U.S.C. § 271(c), by offering to sell or selling within the United States, and/or importing into the United States, components in connection with the Google Wireless Audio System that contribute to the direct infringement of the '206 Patent by users of the Google Wireless Audio System. In particular, (a) Google had actual knowledge of the '206 Patent or was willfully blind to its existence prior to, and no later than, October 2016 and had actual knowledge or was willfully blind to Sonos's infringement allegations at least as early as September 28, 2020 when Sonos provided Google a copy of the complaint (*see* ¶¶ 19-29 above), (b) Google offers for sale, sells, and/or imports, in

connection with the Google Wireless Audio System, one or more material components of the invention of the '206 Patent that are not staple articles of commerce suitable for substantial noninfringing use, (c) Google knows (or should know) that such component(s) were especially made or especially adapted for use in an infringement of the '206 Patent, and (d) users of devices that comprise such material component(s) directly infringe one or more claims of the '206 Patent. For instance, at a minimum, Google offers for sale, sells, and/or imports the Google Home app for installation on devices (*e.g.*, smartphones, tablets, and computers) that meet one or more claims of the '206 Patent. *See, e.g.*, Exs. 22-23. This app is a material component of the devices that meet the one or more claims of the '206 Patent. Further, Google especially made and/or adapted this app for installation and use on devices that meet the one or more claims of the '206 Patent, and this app is not a staple article of commerce suitable for substantial noninfringing use. Google's customers then directly infringe the one or more claims of the '206 Patent by installing and/or using the Google Home app on the customers' devices.

110. Google's infringement of the '206 Patent is also willful because Google (a) had actual knowledge of the '206 Patent no later than October 2016 and actual knowledge of Sonos's infringement contentions no later than September 28, 2020 (*see* ¶¶ 19-29 above), (b) engaged in the aforementioned activity despite an objectively high likelihood that Google's actions constituted infringement of the '206 Patent, and (c) this objectively-defined risk was either known or so obvious that it should have been known to Google.

111. Additional allegations regarding Google's pre-suit knowledge of the '206 Patent and willful infringement will likely have evidentiary support after a reasonable opportunity for discovery.

112. Sonos is in compliance with any applicable marking and/or notice provisions of 35 U.S.C. § 287 with respect to the '206 Patent.

113. Sonos is entitled to recover from Google all damages that Sonos has sustained as a result of Google's infringement of the '206 Patent, including, without limitation, a reasonable royalty and lost profits.

114. Google's infringement of the '206 Patent was and continues to be willful and deliberate, entitling Sonos to enhanced damages.

115. Google's infringement of the '206 Patent is exceptional and entitles Sonos to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

116. Google's infringement of the '206 Patent has caused irreparable harm (including the loss of market share) to Sonos and will continue to do so unless enjoined by this Court.

COUNT IV: INFRINGEMENT OF U.S. PATENT NO. 10,469,966

117. Sonos incorporates by reference and re-alleges paragraphs 1-79 of this Complaint as if fully set forth herein.

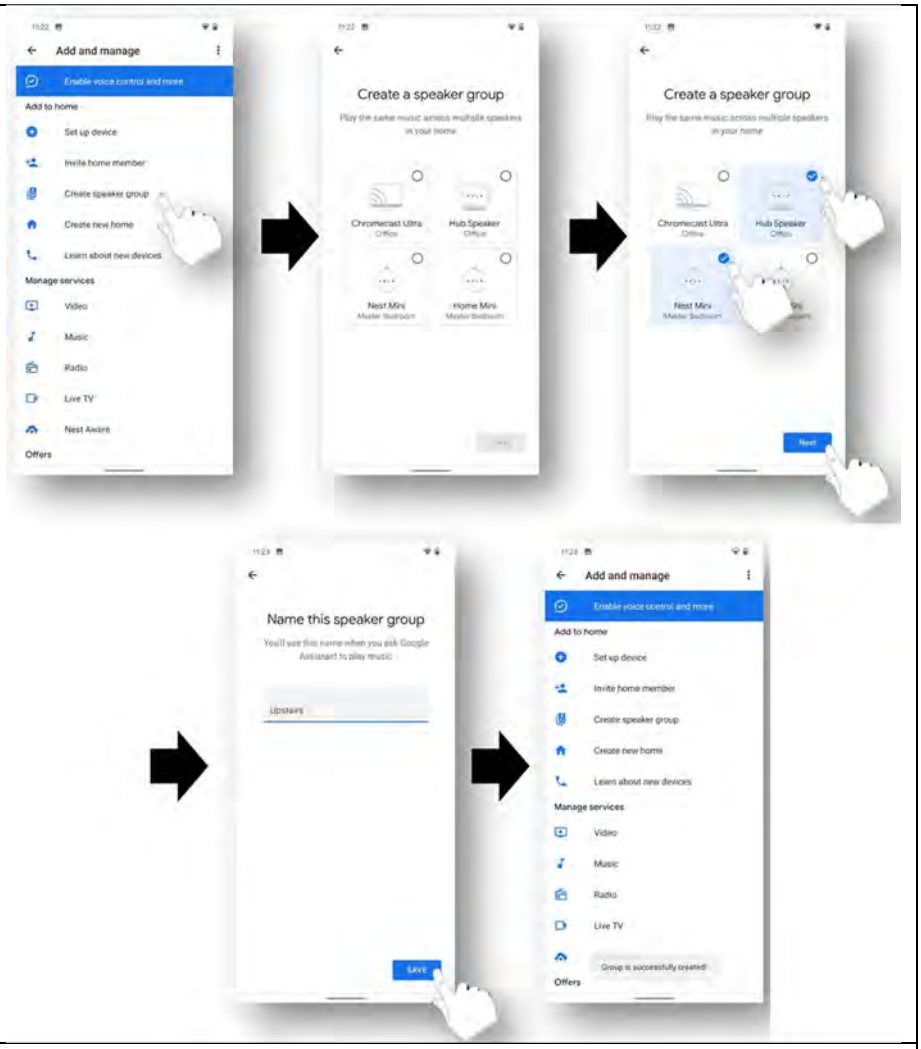
118. Google and/or users of the Google Wireless Audio System have directly infringed (either literally or under the doctrine of equivalents) and continue to directly infringe one or more of the claims of the '966 Patent, in violation of 35 U.S.C. § 271(a), by making, using, offering for sale, and/or selling the Google Wireless Audio System within the United States and/or importing the Google Wireless Audio System into the United States without authority or license.

119. As just one non-limiting example, set forth below is an exemplary infringement claim chart for claim 1 of the '966 Patent in connection with the Google Wireless Audio System. This claim chart is based on publicly available information. Sonos reserves the right to modify this claim chart, including, for example, on the basis of information about the Google Wireless Audio System that it obtains during discovery.

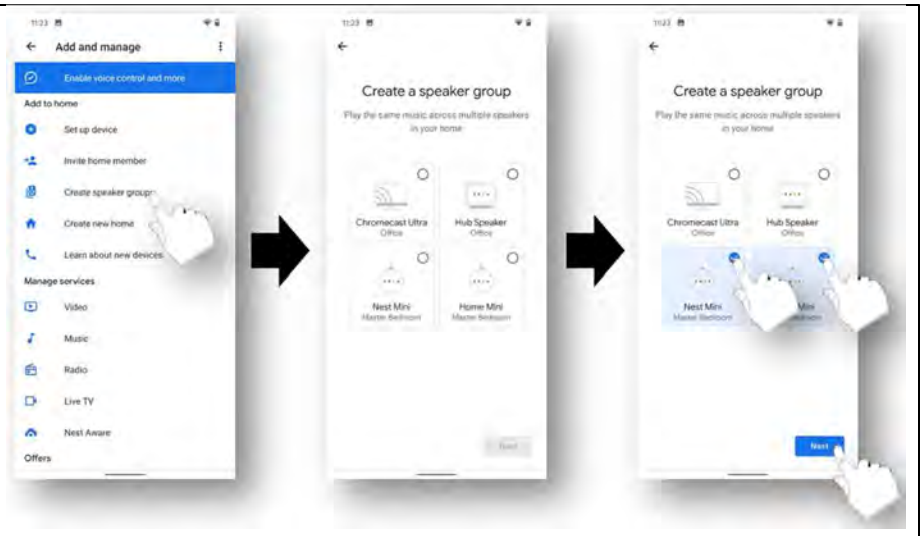
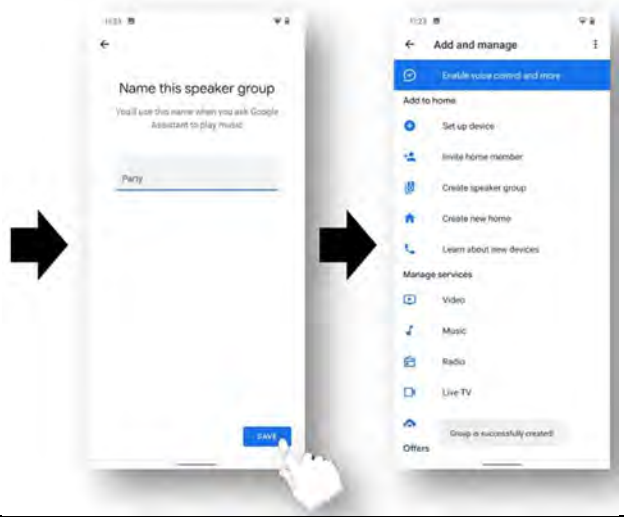
Claim: 1	Chromecast-Enabled Computing Devices
A computing device comprising:	At least each smartphone, tablet, and computer installed with at least the Google Home app (where a computing device installed with at least the Google Home app is referred to herein as a "Chromecast-enabled computing device") comprises a "computing device," as recited in claim 1. At least each Home Mini, Nest Mini, Home, Home Max, Home Hub, Nest Hub, Nest Hub Max, Nest Wifi Point, Chromecast, Chromecast Audio, Chromecast Ultra, Chromecast with Google TV, and Nest Audio ("Chromecast-enabled media player") is a data network device configured to process and output audio, and thus, comprises a "zone player" as recited in claim 1. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel;

	https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs; https://store.google.com/us/product/google_home_max?hl=en-US; https://store.google.com/us/product/google_home_max_partners?hl=en-US; https://play.google.com/store/apps/details?id=com.google.android.apps.chromecast.app&hl=en_US.
one or more processors;	Each Chromecast-enabled computing device includes one or more processors. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs.
a non-transitory computer-readable medium; and	Each Chromecast-enabled computing device includes a non-transitory computer-readable medium. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs.
program instructions stored on the non-transitory computer-readable medium that, when executed by the one or more processors, cause the computing device to perform functions comprising:	Each Chromecast-enabled computing device includes program instructions stored on the non-transitory computer-readable medium that enable the Chromecast-enabled computing device to perform the functions identified below. *See, e.g.,* https://store.google.com/us/magazine/compare_pixel; https://store.google.com/us/product/google_pixelbook_specs; https://store.google.com/us/product/pixel_slate_specs.
while serving as a controller for a networked media playback system comprising a first zone player and at least two other zone players, wherein the first zone player is operating in a standalone mode in which the first zone player is configured to play back media individually:	Each Chromecast-enabled computing device comprises program instructions that, when executed by a Chromecast-enabled computing device's one or more processors, cause that Chromecast-enabled computing device to, while serving as a Chromecast-enabled computing device for a Chromecast-enabled playback system comprising a first Chromecast-enabled media player and at least two other Chromecast-enabled media players, where the first Chromecast-enabled media player is operating in a standalone mode in which the first Chromecast-enabled media player is configured to play back media individually, perform the functions identified below. For instance, each Chromecast-enabled computing device is programmed with the capability to serve as a controller for a Chromecast-enabled playback system that includes a first Chromecast-enabled media player and at least two other Chromecast-enabled media players, where at least the first Chromecast-enabled

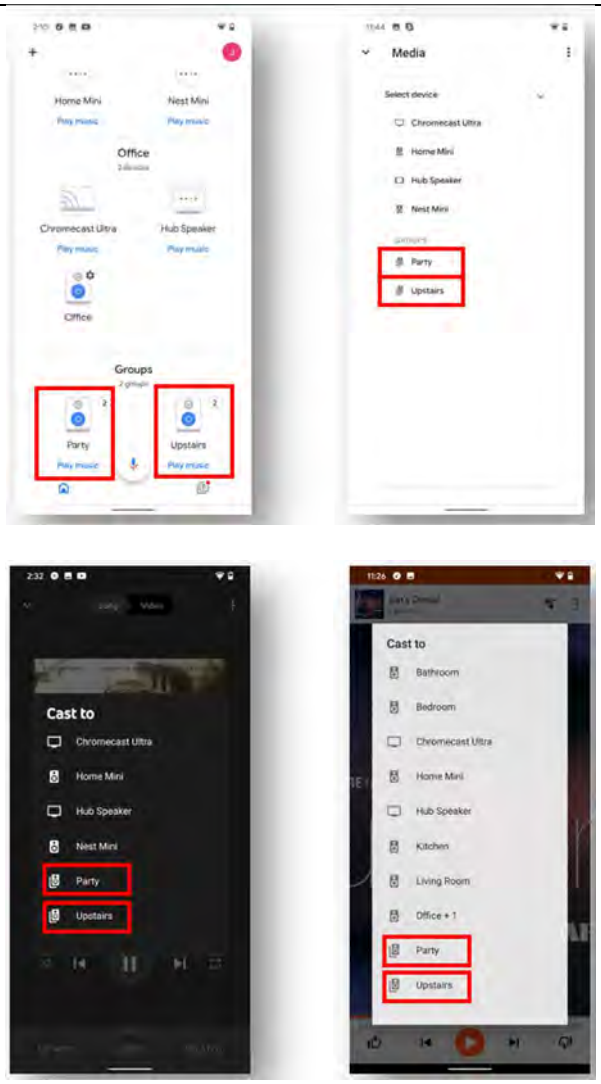
	media player is operating in a standalone mode (*i.e.*, the first Chromecast-enabled media player is not operating part of an established "cast session" with a "speaker group"). *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/googlenest/answer/7030379?co=GENIE.Platform%3DAndroid&hl=en-GB; https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1.
receiving a first request to create a first zone scene comprising a first predefined grouping of zone players including at least the first zone player and a second zone player that are to be configured for synchronous playback of media when the first zone scene is invoked;	Each Chromecast-enabled computing device comprises program instructions that, when executed by a Chromecast-enabled computing device's one or more processors, cause that Chromecast-enabled computing device to receive a first request to create a first zone scene comprising a first predefined grouping of Chromecast-enabled media players including at least the first Chromecast-enabled media player and a second Chromecast-enabled media player that are to be configured for synchronous playback of media when the first zone scene is invoked. For instance, each Chromecast-enabled computing device is programmed such that, while serving as a controller for a Chromecast-enabled playback system that includes a first Chromecast-enabled media player and at least two other Chromecast-enabled media players, the Chromecast-enabled computing device is operable to receive a request to create a first predefined "speaker group" that includes the first Chromecast-enabled media player and a second Chromecast-enabled media player in the Chromecast-enabled playback system that are to be configured for synchronous playback of media when the first "speaker group" is launched, which is a "a first zone scene comprising a first predefined grouping of zone players including at least the first zone player and a second zone player that are to be configured for synchronous playback of media when the first zone scene is invoked." *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en (providing instructions on how to create "speaker groups" for "synchronous music throughout the home"). One example of this functionality is illustrated by the following screenshots, which shows the creation of an "Upstairs" "speaker group" that includes the "Nest Mini" and "Hub Speaker" players:

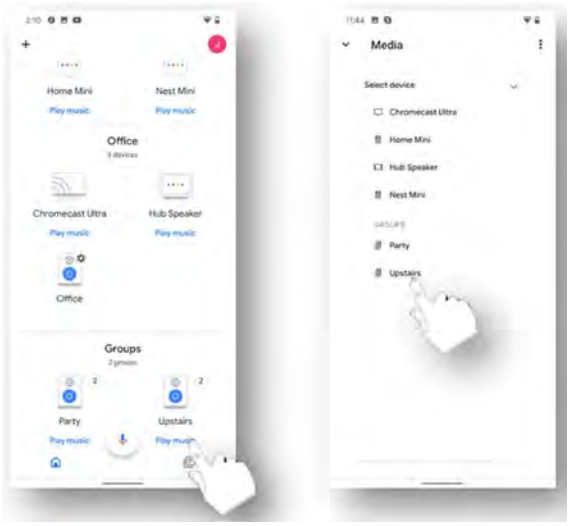
	
based on the first request, i) causing creation of the first zone scene, ii) causing an indication of the first zone scene to be transmitted to the first zone player, and iii) causing storage of the first zone scene;	Each Chromecast-enabled computing device comprises program instructions that, when executed by a Chromecast-enabled computing device's one or more processors, cause that Chromecast-enabled computing device to, based on the first request, (i) cause creation of the first zone scene, (ii) cause an indication of the first zone scene to be transmitted to the first Chromecast-enabled media player, and (iii) cause storage of the first zone scene. For instance, each Chromecast-enabled computing device is programmed such that, while serving as a controller for a Chromecast-enabled playback system that includes a first Chromecast-enabled media player and at least two other Chromecast-enabled media players, the Chromecast-enabled computing device is operable to receive a request to create a first predefined "speaker group" including the first Chromecast-enabled media player and a second Chromecast-enabled media player in the Chromecast-enabled playback system (which is the claimed "first zone scene") and then based on the request, (i) cause creation of the first "speaker group,"

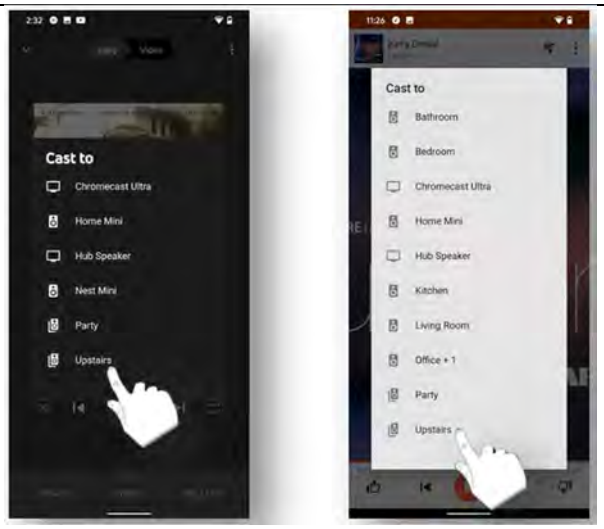
	(ii) cause an indication of the first "speaker group" to be transmitted to the first Chromecast-enabled media player, and (iii) cause storage of the first "speaker group" at one or more Chromecast-enabled media players. *See e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en (providing instructions on how to create "speaker groups").
receiving a second request to create a second zone scene comprising a second predefined grouping of zone players including at least the first zone player and a third zone player that are to be configured for synchronous playback of media when the second zone scene is invoked, wherein the third zone player is different than the second zone player;	Each Chromecast-enabled computing device comprises program instructions that, when executed by a Chromecast-enabled computing device's one or more processors, cause that Chromecast-enabled computing device to receive a second request to create a second zone scene comprising a second predefined grouping of Chromecast-enabled media players including at least the first Chromecast-enabled media player and a third Chromecast-enabled media player that are to be configured for synchronous playback of media when the second zone scene is invoked, where the third Chromecast-enabled media player is different than the second Chromecast-enabled media player. For instance, each Chromecast-enabled computing device is programmed such that, while serving as a controller for a Chromecast-enabled playback system that includes a first Chromecast-enabled media player and at least two other Chromecast-enabled media players, the Chromecast-enabled computing device is configured to receive a request to create a first predefined "speaker group" that includes the first Chromecast-enabled media player and a third Chromecast-enabled media player that are to be configured for synchronous playback of media when the second "speaker group" is launched, which is a "a second zone scene comprising a second predefined grouping of zone players including at least the first zone player and a third zone player that are to be configured for synchronous playback of media when the second zone scene is invoked." *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en (providing instructions on how to create "speaker groups" for "synchronous music throughout the home"). One example of this functionality is illustrated by the following screenshots, which shows the creation of a "Party" "speaker group" that includes the "Nest Mini" and "Home Mini" players:

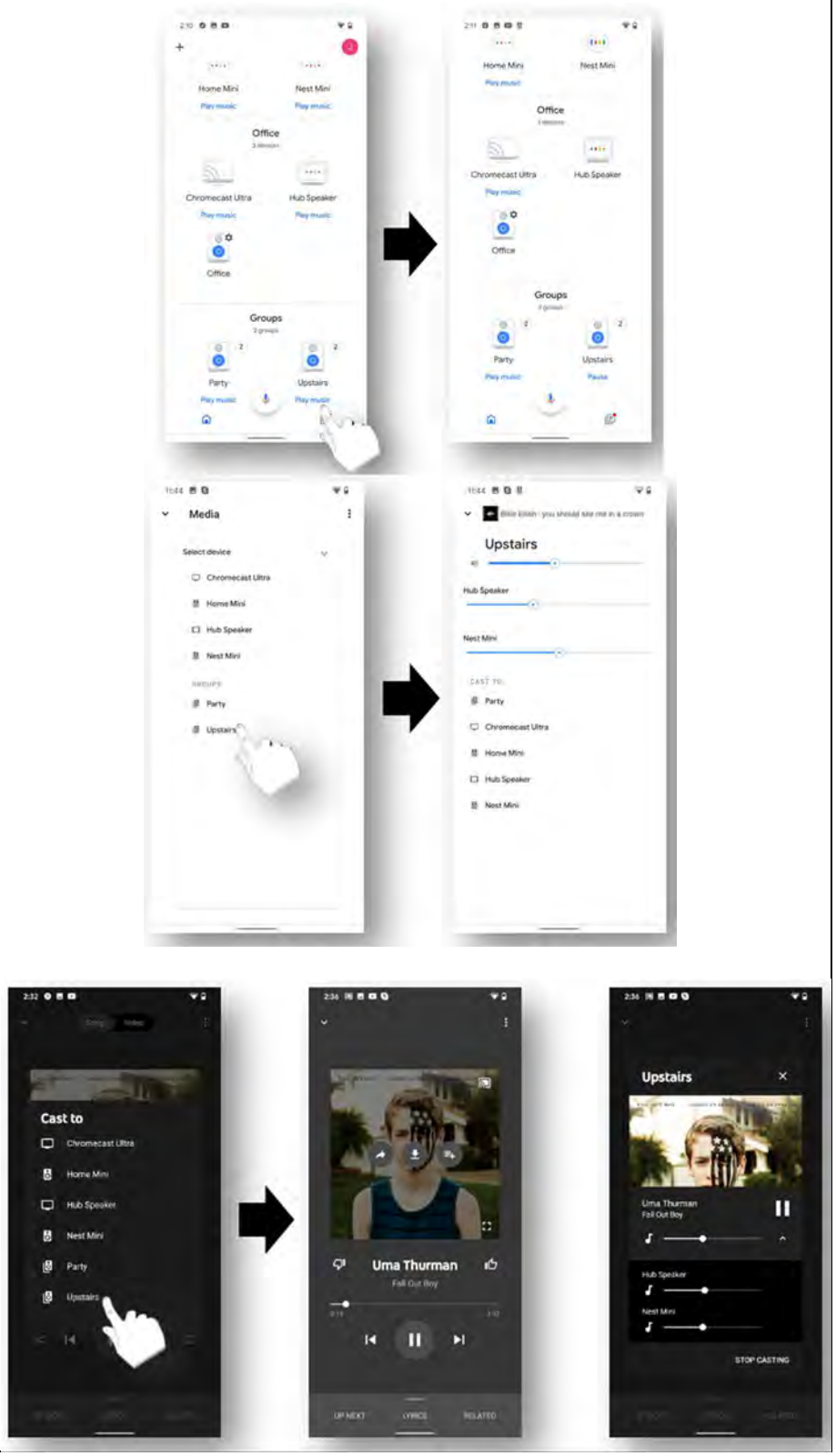
	 
based on the second request, i) causing creation of the second zone scene, ii) causing an indication of the second zone scene to be transmitted to the first zone player, and iii) causing storage of the second zone scene;	Each Chromecast-enabled computing device comprises program instructions that, when executed by a Chromecast-enabled computing device's one or more processors, cause that Chromecast-enabled computing device to, based on the second request, (i) cause creation of the second zone scene, (ii) cause an indication of the second zone scene to be transmitted to the first Chromecast-enabled media player, and (iii) cause storage of the second zone scene. For instance, each Chromecast-enabled computing device is programmed such that, while serving as a controller for a Chromecast-enabled playback system that includes a first Chromecast-enabled media player and at least two other Chromecast-enabled media players, the Chromecast-enabled computing device is operable to receive a request to create a second predefined "speaker group" including the first Chromecast-enabled media player and a third Chromecast-enabled media player in the Chromecast-enabled playback system (which is the claimed "second zone scene") and then

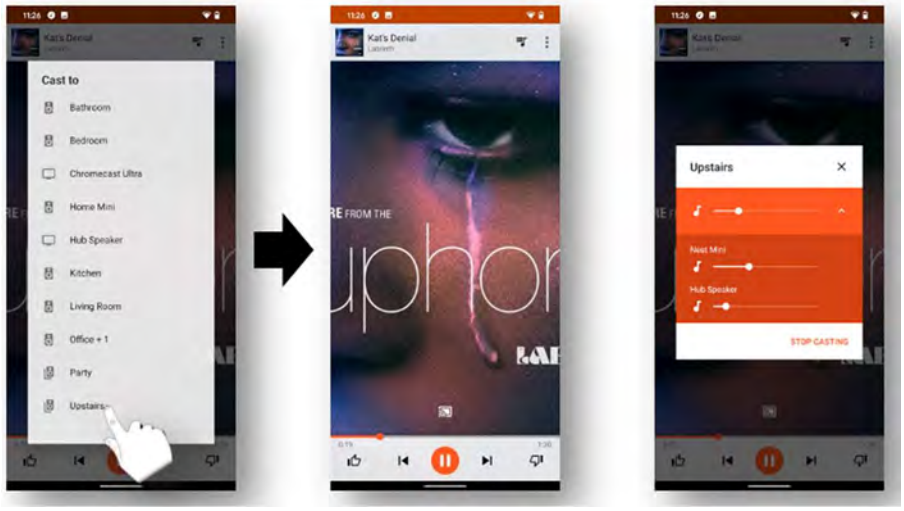
	based on the request, (i) cause creation of the second "speaker group," (ii) cause an indication of the second "speaker group" to be transmitted to the first Chromecast-enabled media player, and (iii) cause storage of the second "speaker group" at one or more Chromecast-enabled media players. *See e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en (providing instructions on how to create "speaker groups").
displaying a representation of the first zone scene and a representation of the second zone scene; and	Each Chromecast-enabled computing device comprises program instructions that, when executed by a Chromecast-enabled computing device's one or more processors, cause that Chromecast-enabled computing device to display a representation of the first zone scene and a representation of the second zone scene. For instance, each Chromecast-enabled computing device is programmed such that, while serving as a controller for a Chromecast-enabled playback system that includes a first Chromecast-enabled media player and at least two other Chromecast-enabled media players that are each, the Chromecast-enabled computing device is operable to display (i) a representation of a first predefined "speaker group" including the first Chromecast-enabled media player and a second Chromecast-enabled media player (which is the claimed "first zone scene"), and (ii) a representation of a second predefined "speaker group" including the first Chromecast-enabled media player and a third Chromecast-enabled media player (which is the claimed second zone scene"). *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/googlenest/answer/7030379?co=GENIE.Platform%3DAndroid&hl=en-GB; https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1. Examples of this functionality are illustrated by the following screenshots from a Chromecast-enabled computing device installed with at least the Google Home, Google Play Music, and YouTube Music apps, which show a displayed representation of the "Upstairs" "speaker group" that includes the "Nest Mini" and "Hub Speaker" players, and a displayed representation of the "Party" "speaker group" that includes the "Nest Mini" and "Home Mini" players:

	
while displaying the representation of the first zone scene and the representation of the second zone scene, receiving a third request to invoke the first zone scene; and	Each Chromecast-enabled computing device comprises program instructions that, when executed by a Chromecast-enabled computing device's one or more processors, cause that Chromecast-enabled computing device to, while displaying the representation of the first zone scene and the representation of the second zone scene, receive a third request to invoke the first zone scene. For instance, each Chromecast-enabled computing device is programmed such that, while displaying (i) a representation of a first predefined "speaker group" including the first Chromecast-enabled media player and a second Chromecast-enabled media player (which is the claimed "first zone scene"), and (ii) a representation of a second predefined "speaker group" including the first Chromecast-enabled media player and a third Chromecast-enabled media player (which is the claimed second zone scene"), the Chromecast-enabled computing device is operable to receive a request to launch the first

	"speaker group," which is a "request to invoke the first zone scene." *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/chromecast/answer/6178107?co=GENIE.Platform%3DAndroid&hl=en; https://support.google.com/googlenest/answer/7030379?co=GENIE.Platform%3DAndroid&hl=en-GB; https://support.google.com/googlenest/answer/7181830?hl=en-GB&ref_topic=7030084; https://support.google.com/chromecast/answer/3228332?hl=en-GB&ref_topic=4602553&co=GENIE.Platform%3DDesktop&oco=1. Examples of this functionality are illustrated by the following screenshots from a Chromecast-enabled computing device installed with at least the Google Home, Google Play Music, and YouTube Music apps, which show receipt of a request to launch the "Upstairs" "speaker pair": 

	
based on the third request, causing the first zone player to transition from operating in the standalone mode to operating in accordance with the first predefined grouping of zone players such that the first zone player is configured to coordinate with at least the second zone player to output media in synchrony with output of media by at least the second zone player.	Each Chromecast-enabled computing device comprises program instructions that, when executed by a Chromecast-enabled computing device's one or more processors, cause that Chromecast-enabled computing device to, based on the third request, cause the first Chromecast-enabled media player to transition from operating in the standalone mode to operating in accordance with the first predefined grouping of Chromecast-enabled media players such that the first Chromecast-enabled media player is configured to coordinate with at least the second Chromecast-enabled media player to output media in synchrony with output of media by at least the second Chromecast-enabled media player. For instance, each Chromecast-enabled computing device is programmed such that, based on a request to launch a first "speaker group" (which is the claimed "third request to invoke the first zone scene"), the Chromecast-enabled computing device is operable to cause the first Chromecast-enabled media player to transition from operating in a standalone mode to operating in accordance with the first "speaker group" such that the first Chromecast-enabled media player is configured to coordinate with at least the second Chromecast-enabled media player to output audio in synchrony with the output of audio by the second Chromecast-enabled media player. *See, e.g.,* https://support.google.com/googlenest/answer/7174267?co=GENIE.Platform%3DAndroid&hl=en ("Group any combination of Google Nest or Google Home speakers and displays and Chromecast devices together for synchronous music throughout the home."). Examples of this functionality are illustrated by the following screenshots from a Chromecast-enabled computing device installed with at least the Google Home, Google Play Music, and YouTube Music apps, which show the "Upstairs" "speaker group" being launched such that the

	"Nest Mini" and "Hub Speaker" players are configured to coordinate with one another to play audio in synchrony: 



120. On September 28, 2020, Sonos provided Google with a draft of this complaint prior to its filing. That draft identified the '966 Patent and described how Google's products infringed. Thus, Google had actual knowledge of Sonos's allegation that Google infringed claims of the '966 Patent prior to Sonos filing the complaint in this action.

121. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '966 Patent, in violation of 35 U.S.C. § 271(b), by actively inducing users of the Google Wireless Audio System to directly infringe the one or more claims of the '966 Patent. In particular, (a) Google had actual knowledge of the '966 Patent and Sonos's infringement contentions, or was willfully blind to their existence, no later than September 28, 2020 when Sonos provided Google with a copy of the complaint (*see* ¶¶ 19-29 above), (b) Google intentionally causes, urges, or encourages users of the Google Wireless Audio System to directly infringe one or more claims of the '966 Patent by promoting, advertising, and instructing customers and potential customers about the Google Wireless Audio System (including uses thereof) and encouraging such customers and potential customers to engage in activity that constitutes direct infringement (*see* Exs. 22-23; *see also* citations above in the exemplary infringement claim chart for claim 1 of the '966 Patent), (c) Google knows (or should know) that its actions will induce users of the Google Wireless Audio System to directly infringe

one or more claims the '966 Patent, and (d) users of the Google Wireless Audio System directly infringe one or more claims of the '966 Patent. For instance, at a minimum, Google has supplied and continues to supply the Google Home app to customers while knowing that installation and/or use of this app will infringe one or more claims of the '966 Patent, and that Google's customers then directly infringe one or more claims of the '966 Patent by installing and/or using this app in accordance with Google's product literature. *See*, e.g., *id*.

122. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '966 Patent, in violation of 35 U.S.C. § 271(c), by offering to sell or selling within the United States, and/or importing into the United States, components in connection with the Google Wireless Audio System that contribute to the direct infringement of the '966 Patent by users of the Google Wireless Audio System. In particular, (a) Google had actual knowledge of the '966 Patent and Sonos's infringement contentions, or was willfully blind to their existence, no later than September 28, 2020 when Sonos provided Google with a copy of the complaint (*see* ¶¶ 19-29 above), (b) Google offers for sale, sells, and/or imports, in connection with the Google Wireless Audio System, one or more material components of the invention of the '966 Patent that are not staple articles of commerce suitable for substantial noninfringing use, (c) Google knows (or should know) that such component(s) were especially made or especially adapted for use in an infringement of the '966 Patent, and (d) users of devices that comprise such material component(s) directly infringe one or more claims of the '966 Patent. For instance, at a minimum, Google offers for sale, sells, and/or imports the Google Home app for installation on devices (*e.g.*, smartphones, tablets, and computers) that meet one or more claims of the '966 Patent. *See, e.g.*, Exs. 22-23. This app is a material component of the devices that meet the one or more claims of the '966 Patent. Further, Google especially made and/or adapted this app for installation and use on devices that meet the one or more claims of the '966 Patent, and this app is not a staple article of commerce suitable for substantial noninfringing use. Google's customers then directly infringe the one or more claims of the '966 Patent by installing and/or using the Google Home app on the customers' devices.

123. Google's infringement of the '966 Patent is also willful because Google (a) had actual knowledge of the '966 Patent and actual knowledge of Sonos's infringement contentions no later than September 28, 2020 (*see* ¶¶ 19-29 above), (b) engaged in the aforementioned activity despite an objectively high likelihood that Google's actions constituted infringement of the '966 Patent, and (c) this objectively-defined risk was either known or so obvious that it should have been known to Google.

124. Additional allegations regarding Google's pre-suit knowledge of the '966 Patent and willful infringement will likely have evidentiary support after a reasonable opportunity for discovery.

125. Sonos is in compliance with any applicable marking and/or notice provisions of 35 U.S.C. § 287 with respect to the '966 Patent.

126. Sonos is entitled to recover from Google all damages that Sonos has sustained as a result of Google's infringement of the '966 Patent, including, without limitation, a reasonable royalty and lost profits.

127. Google's infringement of the '966 Patent was and continues to be willful and deliberate, entitling Sonos to enhanced damages.

128. Google's infringement of the '966 Patent is exceptional and entitles Sonos to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

129. Google's infringement of the '966 Patent has caused irreparable harm (including the loss of market share) to Sonos and will continue to do so unless enjoined by this Court.

COUNT V: INFRINGEMENT OF U.S. PATENT NO. 9,219,460

130. Sonos incorporates by reference and re-alleges paragraphs 1-79 of this Complaint as if fully set forth herein.

131. Google and/or users of the Google Wireless Audio System have directly infringed (either literally or under the doctrine of equivalents) and continue to directly infringe one or more of the claims of the '460 Patent, in violation of 35 U.S.C. § 271(a), by making, using, offering for

sale, and/or selling the Google Wireless Audio System within the United States and/or importing the Google Wireless Audio System into the United States without authority or license.

132. As just one non-limiting example, set forth below is an exemplary infringement claim chart for claim 15 of the '460 Patent in connection with the Google Wireless Audio System. This claim chart is based on publicly available information. Sonos reserves the right to modify this claim chart, including, for example, on the basis of information about the Google Wireless Audio System that it obtains during discovery.

Claim: 15	Chromecast-Enabled Media Players
A playback device, comprising:	At least each Google Home Max and Nest Audio player (referred to herein as a "Chromecast-enabled media player") comprises a "playback device," as recited in claim 15.
a speaker;	Each of the foregoing Chromecast-enabled media players includes a speaker. *See, e.g.,* https://support.google.com/googlenest/answer/7072284?hl=en; https://store.google.com/us/product/google_home_max_specs_speaker?hl=en-US.
a microphone that is physically coupled to the speaker;	Each of the foregoing Chromecast-enabled media players includes a microphone that is physically coupled to the speaker. *See, e.g.,* https://support.google.com/googlenest/answer/7072284?hl=en; https://store.google.com/us/product/google_home_max_specs_speaker?hl=en-US.
a processor;	Each of the foregoing Chromecast-enabled media players includes a processor. *See, e.g.,* https://support.google.com/googlenest/answer/7072284?hl=en; https://store.google.com/us/product/google_home_max_specs_speaker?hl=en-US.
a network interface;	Each of the foregoing Chromecast-enabled media players includes a network interface, such as a WiFi interface. *See, e.g.,* https://support.google.com/googlenest/answer/7072284?hl=en; https://store.google.com/us/product/google_home_max_specs_speaker?hl=en-US.
a data storage; and a program logic stored in the data storage and executable by the processor to:	Each of the foregoing Chromecast-enabled media players includes a data storage and executable program logic stored in the data storage that enable each Chromecast-enabled media player to perform the functions identified below. *See, e.g.,* https://support.google.com/googlenest/answer/7072284?hl=en; https://store.google.com/us/product/google_home_max_specs_speaker?hl=en-US.

emit a first audio signal from the speaker;	Each of the foregoing Chromecast-enabled media players comprises program logic that, when executed by the Chromecast-enabled media player's processor, causes that Chromecast-enabled media player to emit a first audio signal from the speaker. For instance, each of the foregoing Chromecast-enabled media players is programmed with the capability to emit a first audio signal from one of its speakers to facilitate measuring the acoustics of a space surrounding the Chromecast-enabled media player. *See, e.g.,* https://support.google.com/googlenest/answer/7585574?hl=en ("Once you set up Max, Room EQ measures the acoustics of your space."); https://www.youtube.com/watch?v=UiBhshQ0FQA ("With Smart Sound, Google Home Max uses machine learning to automatically adjust the equalizer settings to match the acoustics of your room.").
detect, via the microphone, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal;	Each of the foregoing Chromecast-enabled media players comprises program logic that, when executed by the Chromecast-enabled media player's processor, causes that Chromecast-enabled media player to detect, via its microphone, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal. For instance, each of the foregoing Chromecast-enabled media players is programmed with the capability to detect, via its microphone, a second audio signal, where at least a portion of the second audio signal is a reflection of the first audio signal that was emitted to facilitate measuring the acoustics of a space surrounding the Chromecast-enabled media player. *See, e.g.,* https://support.google.com/googlenest/answer/7585574?hl=en ("Once you set up Max, Room EQ measures the acoustics of your space. . . . Note: The microphone must be on for Room EQ to work."); https://www.youtube.com/watch?v=UiBhshQ0FQA (disclosing that the Google Home Max "uses six internal microphones to measure the acoustics of your room.").
in response to the detecting, determine a first reflection characteristic based on at least the second audio signal;	Each of the foregoing Chromecast-enabled media players comprises program logic that, when executed by the Chromecast-enabled media player's processor, causes that Chromecast-enabled media player to, in response to the detecting, determine a first reflection characteristic based on at least the second audio signal. For instance, each of the foregoing Chromecast-enabled media players is programmed such that, in response to detecting a second audio signal comprising a reflection of a first audio signal that was emitted to facilitate measuring the acoustics of a space surrounding the Chromecast-enabled media player, the Chromecast-enabled media player is configured to determine one or more reflection characteristics based on at least the detected second audio signal. *See,*

	e.g., https://support.google.com/googlenest/answer/7585574?hl=en ("Walls in a room can amplify the bass, leading to a muddled sound in which the bass overpowers the vocals of your music. Room EQ automatically corrects for this excess bass. This leads to a more balanced sound."); https://www.youtube.com/watch?v=UiBhshQ0FQA.
adjust an equalization setting of the playback device based on at least the first reflection characteristic; and	Each of the foregoing Chromecast-enabled media players comprises program logic that, when executed by the Chromecast-enabled media player's processor, causes that Chromecast-enabled media player to adjust the equalization setting of the Chromecast-enabled media player based on at least the first reflection characteristic. For instance, each of the foregoing Chromecast-enabled media players is programmed with the capability to adjust its equalization setting (e.g., a "bass" setting) based on one or more reflection characteristics. *See, e.g.,* https://support.google.com/googlenest/answer/7585574?hl=en ("Room EQ automatically corrects for this excess bass. This leads to a more balanced sound."); https://www.youtube.com/watch?v=UiBhshQ0FQA ("With Smart Sound, Google Home Max uses machine learning to automatically adjust the equalizer settings to match the acoustics of your room.").
play, via the speaker, an audio track according to the equalization setting.	Each of the foregoing Chromecast-enabled media players comprises program logic that, when executed by the Chromecast-enabled media player's processor, causes that Chromecast-enabled media player to play, via its speaker, an audio track according to the equalization setting. For instance, each of the foregoing Chromecast-enabled media players is programmed with the capability to play, via one of its speakers, audio according to the equalization setting (e.g., "bass" setting) that was adjusted as described above. *See, e.g.,* https://support.google.com/googlenest/answer/7585574?hl=en ("Room EQ automatically corrects for this excess bass. This leads to a more balanced sound."); https://www.youtube.com/watch?v=UiBhshQ0FQA ("With Smart Sound, Google Home Max uses machine learning to automatically adjust the equalizer settings to match the acoustics of your room.").

133. On September 28, 2020, Sonos provided Google with a draft of this complaint prior to its filing. That draft identified the '460 Patent and described how Google's products infringed. Thus, Google had actual knowledge of Sonos's allegation that Google infringed claims of the '460 Patent prior to Sonos filing the complaint in this action.

134. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '460 Patent, in violation of 35 U.S.C. § 271(b), by actively inducing users of the Google Wireless Audio System to directly infringe the one or more claims of the '460 Patent. In particular, (a) Google had actual knowledge of the '460 Patent or was willfully blind to its existence prior to, and no later than, January 2018 and had actual knowledge or was willfully blind to Sonos's infringement allegations at least as early as September 28, 2020 when Sonos provided Google a copy of the complaint (*see* ¶¶ 19-29 above), (b) Google intentionally causes, urges, or encourages users of the Google Wireless Audio System to directly infringe one or more claims of the '460 Patent by promoting, advertising, and instructing customers and potential customers about the Google Wireless Audio System (including uses thereof) and encouraging such customers and potential customers to engage in activity that constitutes direct infringement (*see* citations above in the exemplary infringement claim chart for claim 15 of the '460 Patent; *see also* Ex. 42), (c) Google knows (or should know) that its actions will induce users of the Google Wireless Audio System to directly infringe one or more claims the '460 Patent, and (d) users of the Google Wireless Audio System directly infringe one or more claims of the '460 Patent. For instance, at a minimum, Google has supplied and continues to supply the Google Home Max and Nest Audio to customers while knowing that use of these products will infringe one or more claims of the '460 Patent and that Google's customers then directly infringe one or more claims of the '460 Patent by using the Google Home Max and Nest Audio in accordance with Google's product literature. *See, e.g.*, *id*.

135. Additionally and/or alternatively, Google has indirectly infringed and continues to indirectly infringe one or more of the claims of the '460 Patent, in violation of 35 U.S.C. § 271(c), by offering to sell or selling within the United States, and/or importing into the United States, components in connection with the Google Wireless Audio System that contribute to the direct infringement of the '460 Patent by users of the Google Wireless Audio System. In particular, (a) Google had actual knowledge of the '460 Patent or was willfully blind to its existence prior to, and no later than, January 2018 and had actual knowledge or was willfully blind to Sonos's

infringement allegations at least as early as September 28, 2020 when Sonos provided Google a copy of the complaint (*see* ¶¶ 19-29 above), (b) Google offers for sale, sells, and/or imports, in connection with the Google Wireless Audio System, one or more material components of the invention of the '460 Patent that are not staple articles of commerce suitable for substantial noninfringing use, (c) Google knows (or should know) that such component(s) were especially made or especially adapted for use in an infringement of the '460 Patent, and (d) users of devices that comprise such material component(s) directly infringe one or more claims of the '460 Patent. For instance, at a minimum, Google offers for sale, sells, and/or imports software updates for the Google Home Max and Nest Audio that meet one or more claims of the '460 Patent. *See, e.g.*, Ex. 43. These software updates are material components of the Google Home Max and Nest Audio that meet the one or more claims of the '460 Patent. Further, Google especially made and/or adapted these software updates for installation and use on the Google Home Max and Nest Audio that meet the one or more claims of the '460 Patent, and these software updates are not staple articles of commerce suitable for substantial noninfringing use. Google's customers then directly infringe the one or more claims of the '460 Patent by installing and using software updates on the Google Home Max and Nest Audio.

136. Google's infringement of the '460 Patent is also willful because Google (a) had actual knowledge of the '460 Patent no later than January 2018 and actual notice of Sonos's infringement contentions no later than September 28, 2020 (*see* ¶¶ 19-29 above), (b) engaged in the aforementioned activity despite an objectively high likelihood that Google's actions constituted infringement of the '460 Patent, and (c) this objectively-defined risk was either known or so obvious that it should have been known to Google.

137. Additional allegations regarding Google's pre-suit knowledge of the '460 Patent and willful infringement will likely have evidentiary support after a reasonable opportunity for discovery.

138. Sonos is entitled to recover from Google all damages that Sonos has sustained as a result of Google's infringement of the '460 Patent, including, without limitation, a reasonable royalty and lost profits.

139. Google's infringement of the '460 Patent was and continues to be willful and deliberate, entitling Sonos to enhanced damages.

140. Google's infringement of the '460 Patent is exceptional and entitles Sonos to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285. Google's infringement of the '460 Patent has caused irreparable harm (including the loss of market share) to Sonos and will continue to do so unless enjoined by this Court.

PRAYER FOR RELIEF

WHEREFORE, Sonos respectfully requests:

A. That Judgment be entered that Google has infringed at least one or more claims of the patents-in-suit, directly and/or indirectly, literally and/or under the doctrine of equivalents, and that such infringement is willful;

B. An injunction enjoining Google, its officers, agents, servants, employees and attorneys, and other persons in active concert or participation with Google, and its parents, subsidiaries, divisions, successors and assigns, from further infringement of the patents-in-suit.

C. An award of damages sufficient to compensate Sonos for Google's infringement under 35 U.S.C. § 284, including an enhancement of damages on account of Google's willful infringement;

D. That the case be found exceptional under 35 U.S.C. § 285 and that Sonos be awarded its reasonable attorneys' fees;

E. Costs and expenses in this action;

F. An award of prejudgment and post-judgment interest; and

G. Such other and further relief as the Court may deem just and proper.

DEMAND FOR JURY TRIAL

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, Sonos respectfully demands a trial by jury on all issues triable by jury.

Dated: September 29, 2020

Respectfully submitted,

By: */s/* _____

Attorneys for Plaintiff Sonos, Inc.

EXHIBIT 1

US009967615B2

(12) **United States Patent**
Coburn, IV et al.

(10) **Patent No.: US 9,967,615 B2**
(45) **Date of Patent: *May 8, 2018**

(54) **NETWORKED MUSIC PLAYBACK**

(71) Applicant: **Sonos, Inc**, Santa Barbara, CA (US)

(72) Inventors: **Arthur Coburn, IV**, Cambridge, MA (US); **Joni Hoadley**, Santa Barbara, CA (US)

(73) Assignee: **Sonos, Inc.**, Santa Barbara, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days. days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/628,952**

(22) Filed: **Feb. 23, 2015**

(65) **Prior Publication Data**

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Related U.S. Application Data

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(51) **Int. Cl.**
H04N 7/18 (2006.01)
H04N 21/436 (2011.01)
(Continued)

(52) **U.S. Cl.**
CPC ... ***H04N 21/43615*** (2013.01); ***H04L 65/4084*** (2013.01); ***H04N 21/4307*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H04N 21/43615; H04N 21/6581; H04N 21/439; H04N 21/6125; H04N 21/64322;
(Continued)

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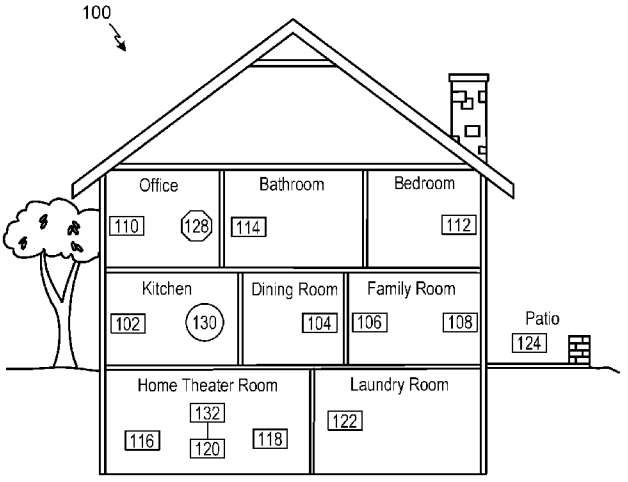
Primary Examiner — Oschat Montoya
(74) *Attorney, Agent, or Firm* — McDonnell Boehnen Hulbert & Berghoff LLP

(57) **ABSTRACT**

Systems, methods, apparatus, and articles of manufacture to facilitate connection to a multimedia playback network are disclosed. An example method includes detecting a first input including an identification of a playback device; detecting a second input including an identification of an item on a controller, wherein multimedia content associated with the item is retrievable from a content provider; detecting a trigger, wherein the trigger is not the first input or the second input; and sending, in response to detecting the trigger, information regarding the multimedia content from the controller to the playback device, wherein the information includes an identification of the multimedia content for playback by the playback device, and wherein the information causes (a) the playback device to retrieve, independent of the controller, the multimedia content from the content provider and (b) playback of the retrieved multimedia content.

29 Claims, 11 Drawing Sheets



(51) **Int. Cl.**

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H04N 21/61	(2011.01)
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(58) **Field of Classification Search**

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See application file for complete search history.

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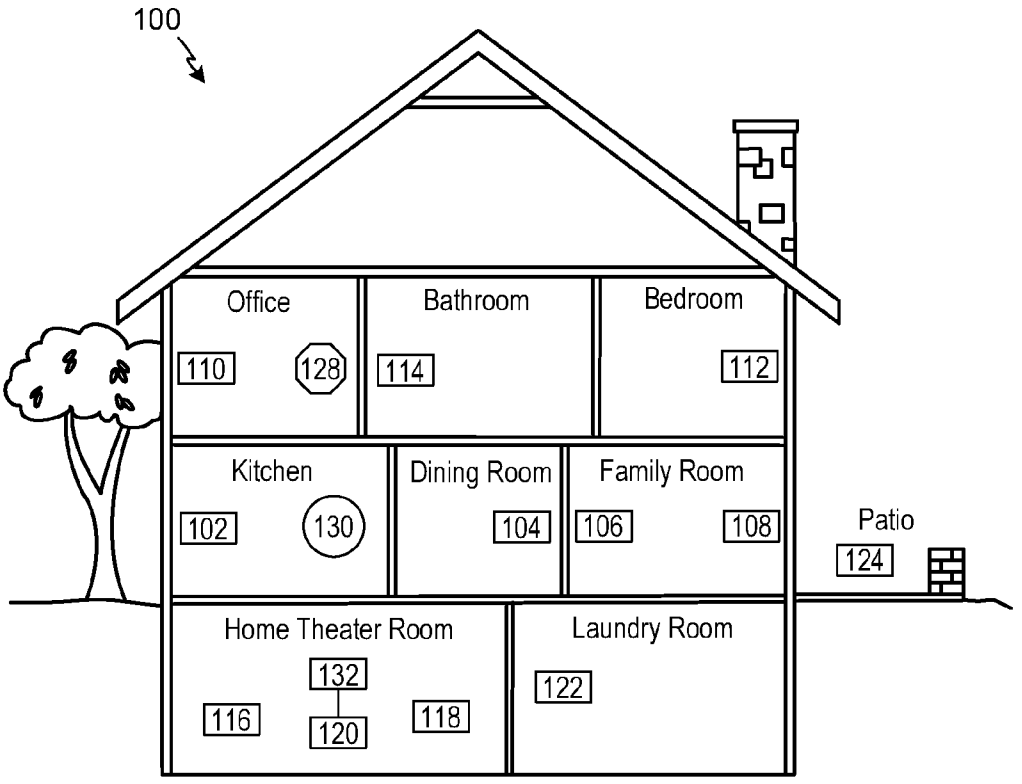
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Bedroom
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Kitchen
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130
Dining Room
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Family Room
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108
Patio
124
Home Theater Room
132
116
120
118
Laundry Room
122

FIGURE 1

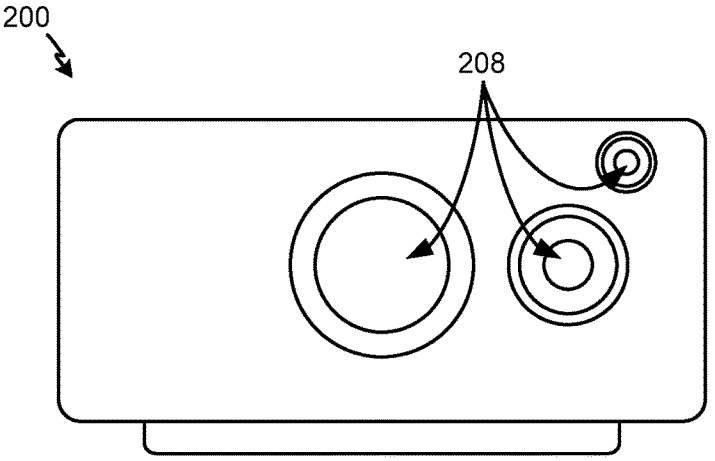


FIGURE 2A

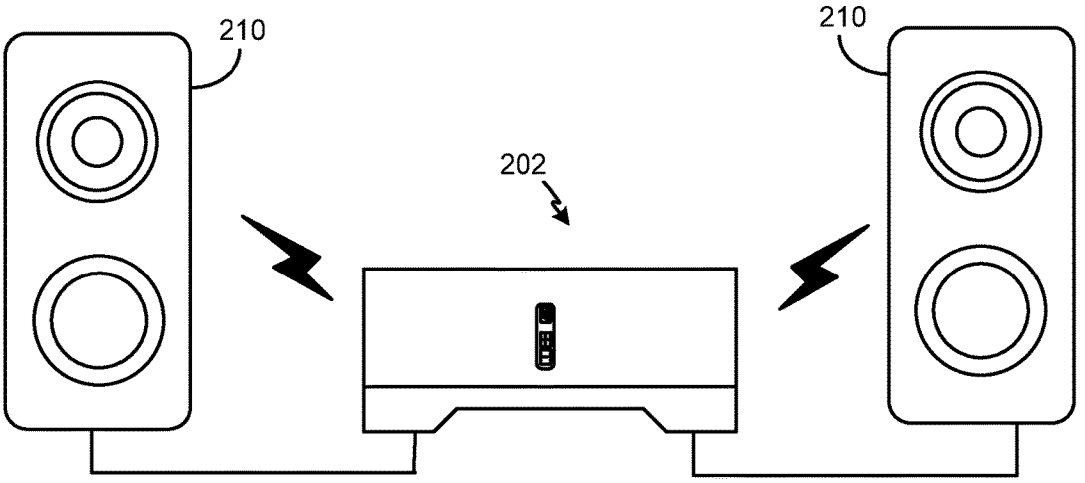


FIGURE 2B

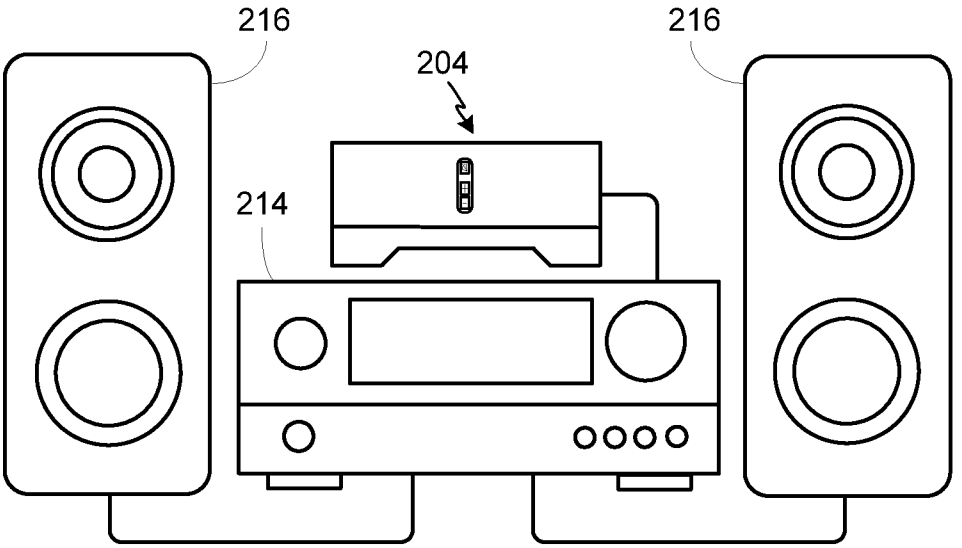
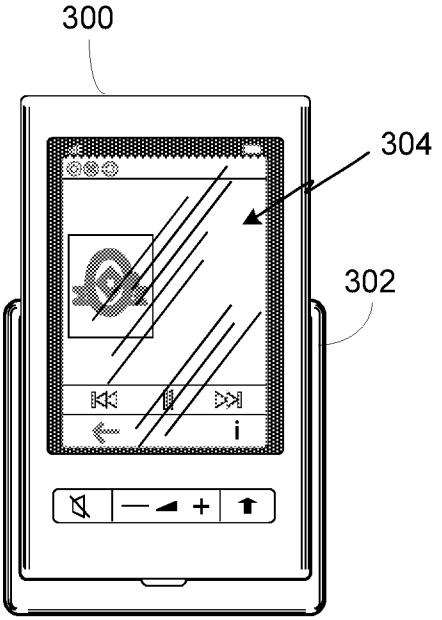


FIGURE 2C



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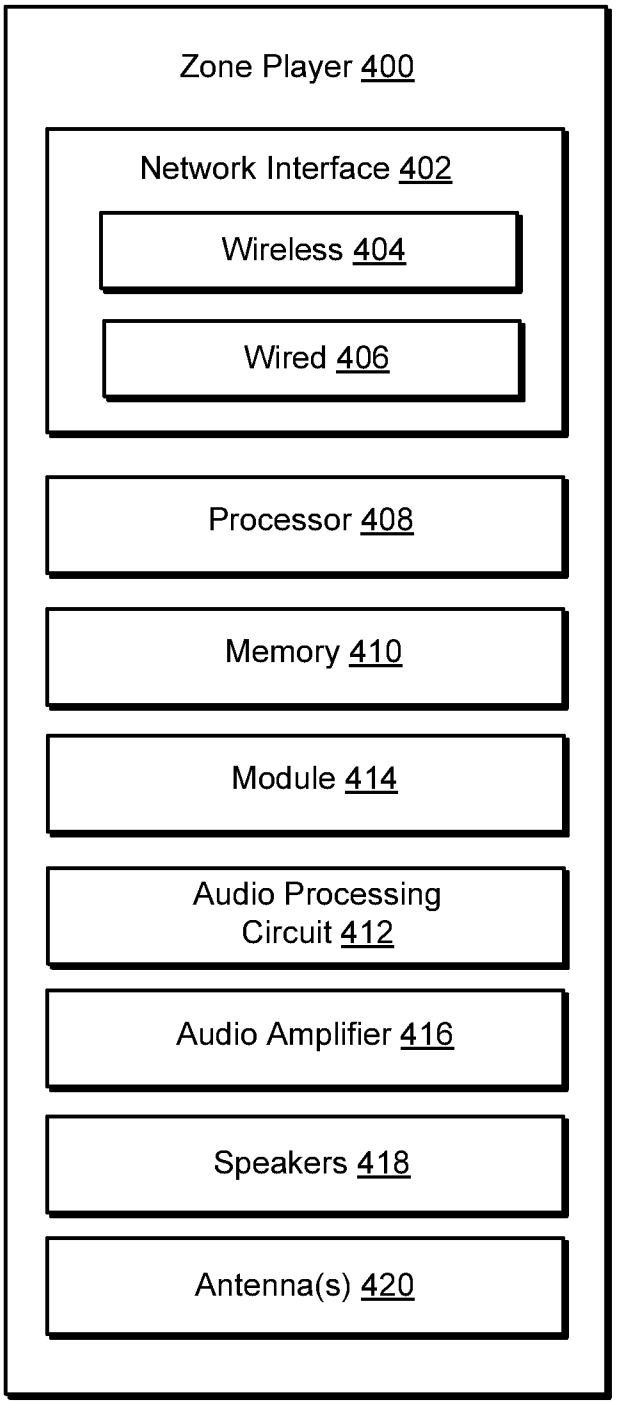
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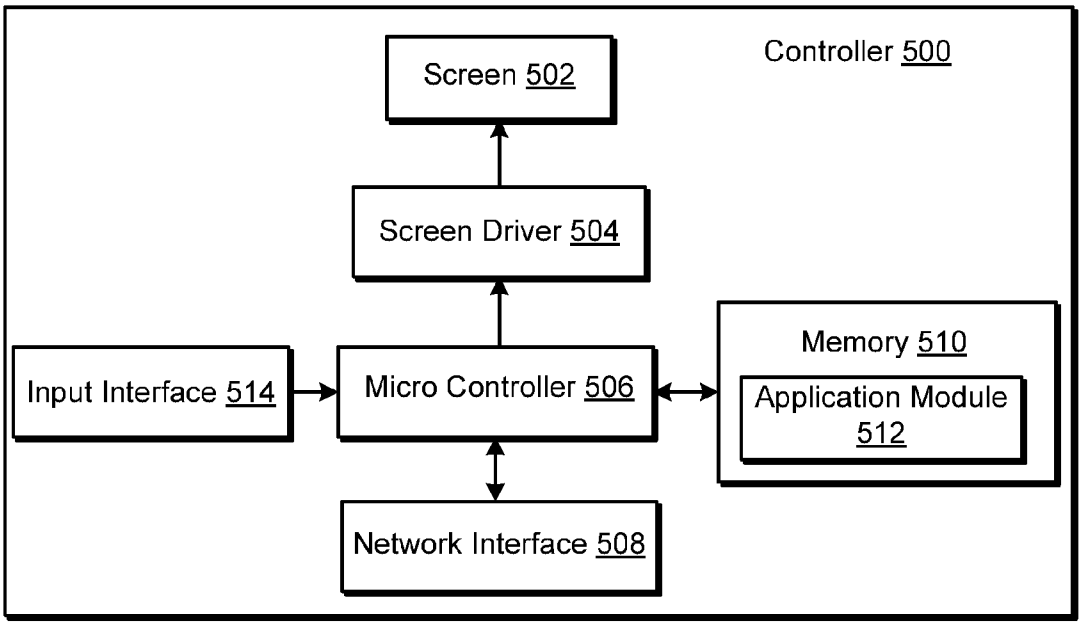
Network Interface 402
Wireless 404
Wired 406
Processor 408
Memory 410
Module 414
Audio Processing Circuit 412
Audio Amplifier 416
Speakers 418
Antenna(s) 420

FIGURE 4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Screen 502
Screen Driver 504
Input Interface 514
Micro Controller 506
Memory 510
Application Module 512
Network Interface 508

FIGURE 5

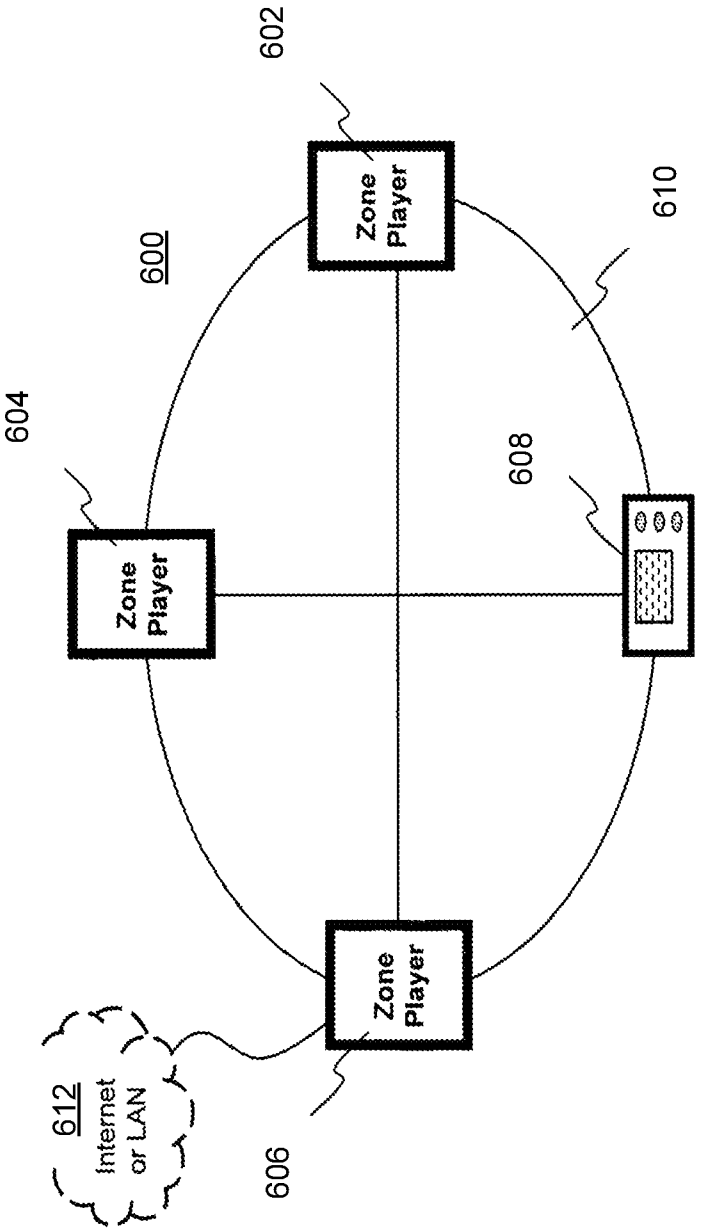
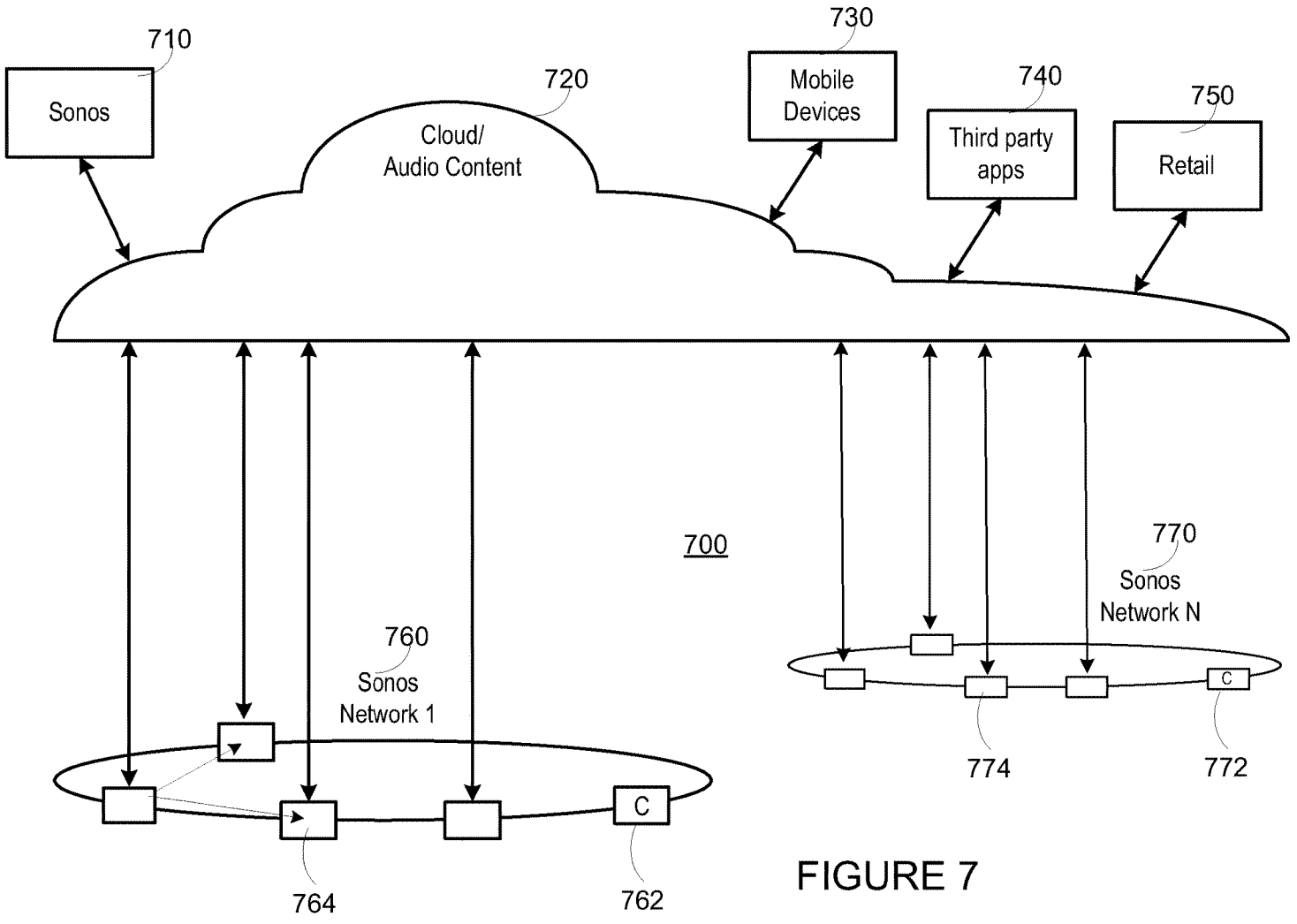

602
600
610
604
608
Zone Player
Zone Player
Zone Player
612
Internet or LAN
606

FIGURE 6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Cloud/
Audio Content
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Mobile
Devices
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Third party
apps
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Retail
700
760
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Network 1
770
Sonos
Network N
C
764
762
774
772
C

FIGURE 7

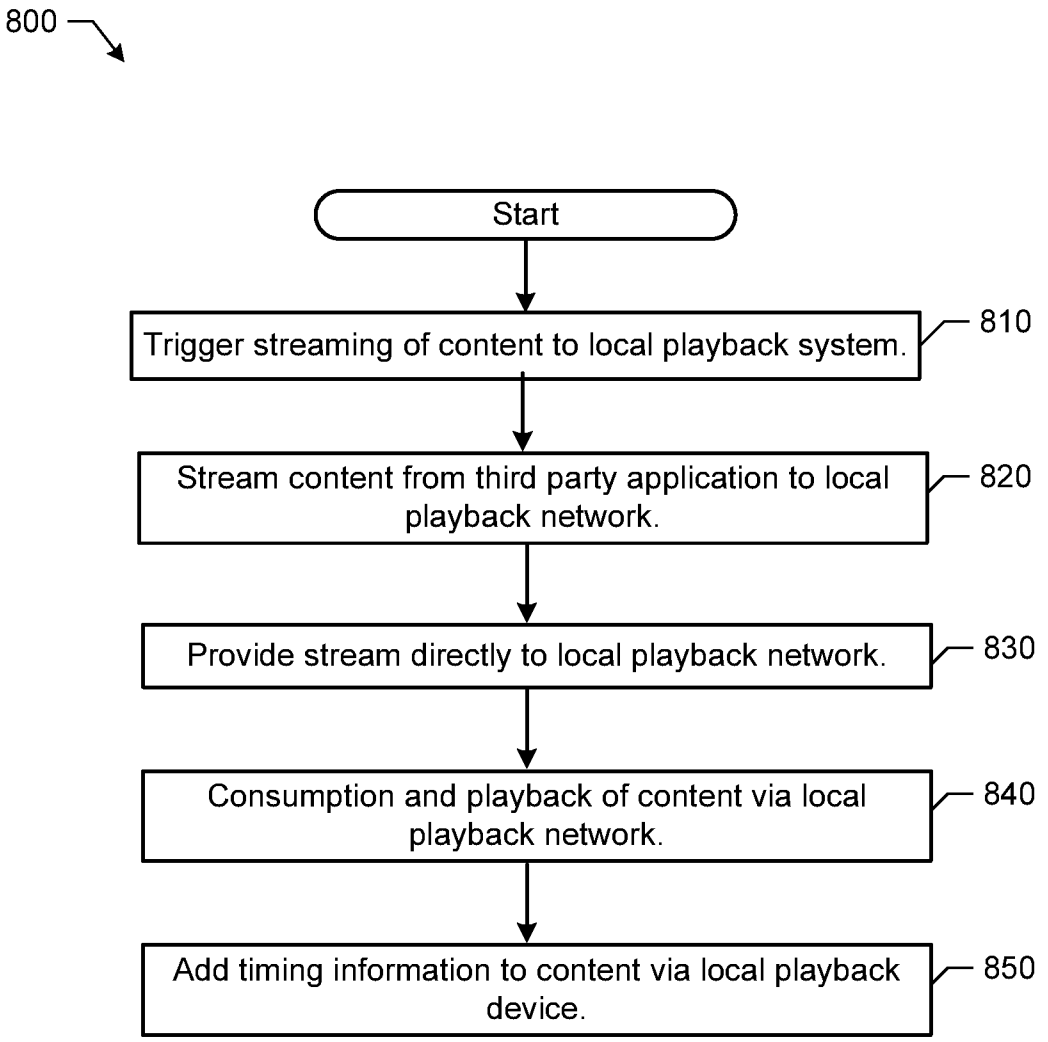
800
Start
Trigger streaming of content to local playback system.
810
Stream content from third party application to local playback network.
820
Provide stream directly to local playback network.
830
Consumption and playback of content via local playback network.
840
Add timing information to content via local playback device.
850

FIGURE 8

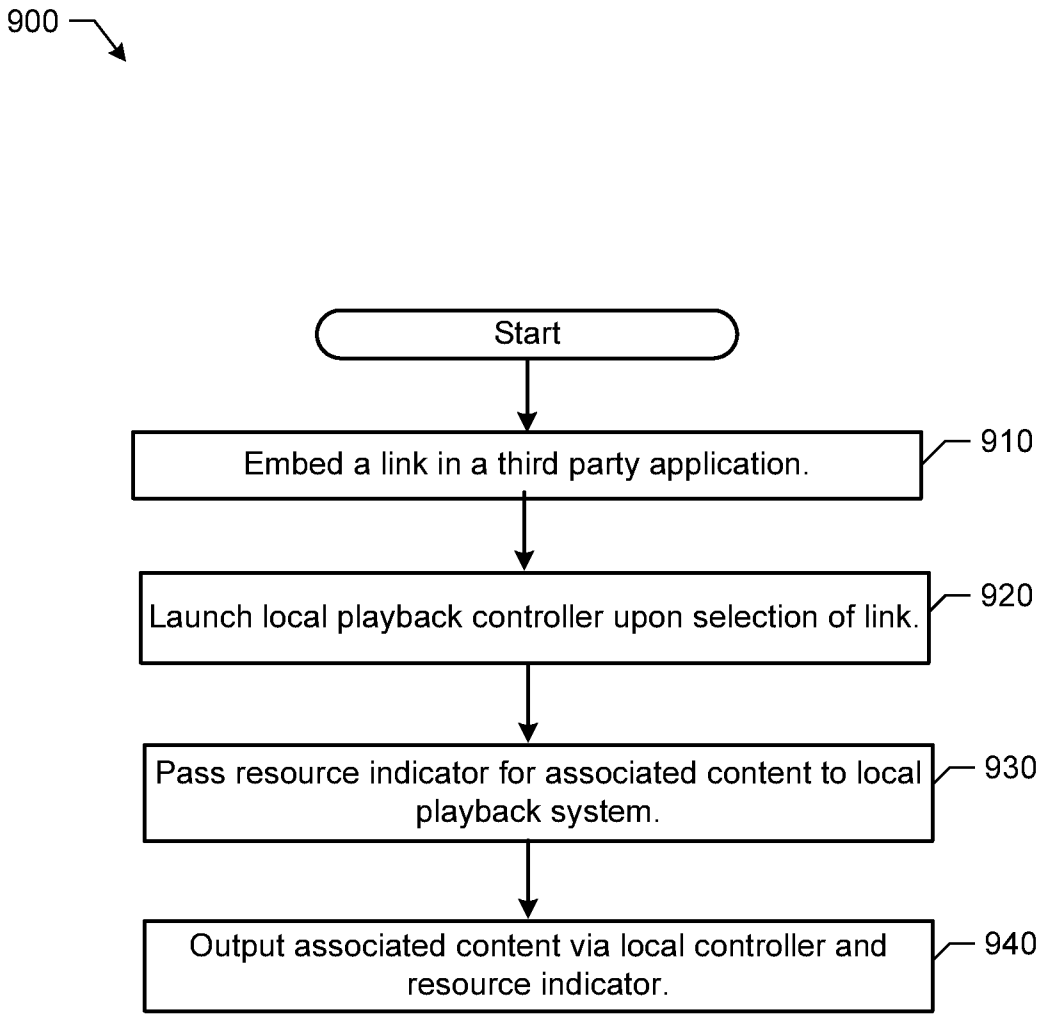
900
Start
Embed a link in a third party application.
910
Launch local playback controller upon selection of link.
920
Pass resource indicator for associated content to local playback system.
930
Output associated content via local controller and resource indicator.
940

FIGURE 9

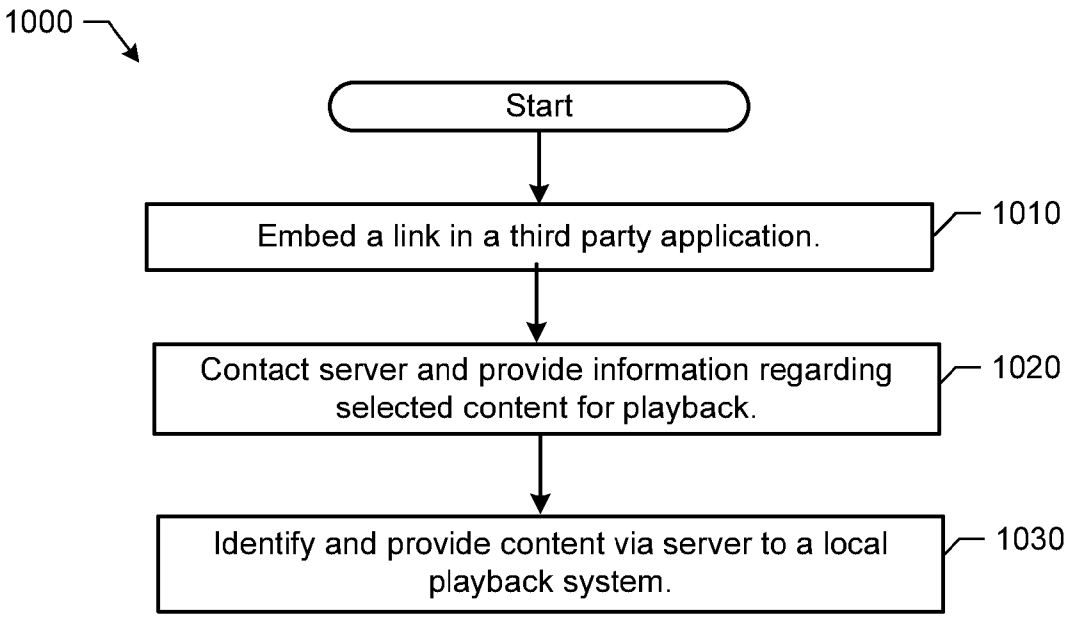
1000
Start
Embed a link in a third party application.
1010
Contact server and provide information regarding selected content for playback.
1020
Identify and provide content via server to a local playback system.
1030

FIGURE 10

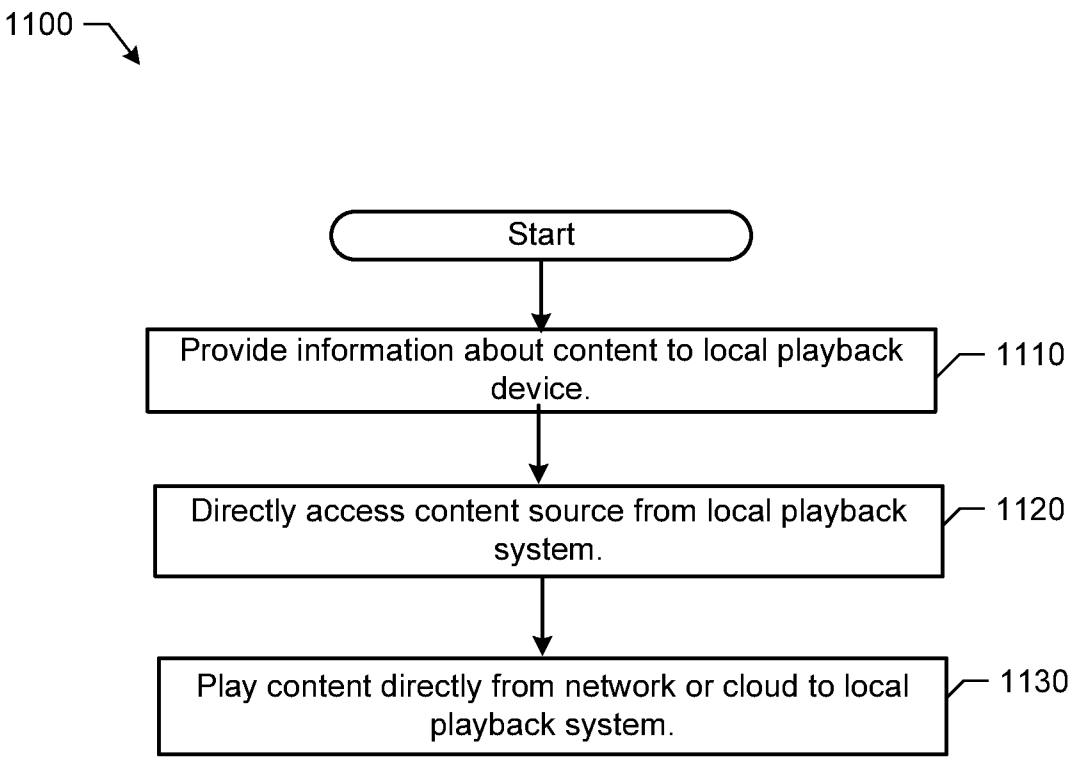
1100
Start
Provide information about content to local playback device.
1110
Directly access content source from local playback system.
1120
Play content directly from network or cloud to local playback system.
1130

FIGURE 11

NETWORKED MUSIC PLAYBACK

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of priority to U.S. Non-Provisional application Ser. No. 13/341,237, filed on Dec. 30, 2011, entitled "Systems and Methods for Networked Music Playback", which is hereby incorporated by reference in its entirety for all purposes.

FIELD OF THE DISCLOSURE

The disclosure is related to consumer electronics and, more particularly, to providing music for playback via one or more devices on a playback data network.

BACKGROUND

Technological advancements have increased the accessibility of music content, as well as other types of media, such as television content, movies, and interactive content. For example, a user can access audio, video, or both audio and video content over the Internet through an online store, an Internet radio station, an online music service, an online movie service, and the like, in addition to the more traditional avenues of accessing audio and video content. Demand for such audio and video content continues to surge. Given the high demand, technology used to access and play such content has likewise improved.

BRIEF DESCRIPTION OF THE DRAWINGS

Features, aspects, and advantages of the presently disclosed technology are better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. **1** shows an illustration of an example system in which embodiments of the methods and apparatus disclosed herein can be implemented;

FIG. **2**A shows an illustration of an example zone player having a built-in amplifier and speakers;

FIG. **2**B shows an illustration of an example zone player having a built-in amplifier and connected to external speakers;

FIG. **2**C shows an illustration of an example zone player connected to an A/V receiver and speakers;

FIG. **3** shows an illustration of an example controller;

FIG. **4** shows an internal functional block diagram of an example zone player;

FIG. **5** shows an internal functional block diagram of an example controller;

FIG. **6** shows an example ad-hoc playback network;

FIG. **7** shows a system including a plurality of networks including a cloud-based network and at least one local playback network; and

FIGS. **8-11** show flow diagrams for methods to provide audio content to a local playback system.

In addition, the drawings are for the purpose of illustrating example embodiments, but it is understood that the present disclosure is not limited to the arrangements and instrumentality shown in the drawings.

DETAILED DESCRIPTION

I. Overview

Wired or wireless networks can be used to connect one or more multimedia playback devices for a home or other location playback network (e.g., a home music system). Certain examples provide automatic configuration of parameters of a playback device to be coupled to a network with reduced or minimum human intervention. For example, a wired and/or wireless ad-hoc network is established to facilitate communications among a group of devices. Music and/or other multimedia content can be shared among devices and/or groups of devices (also referred to herein as zones) associated with a playback network.

Certain embodiments facilitate streaming or otherwise providing music from a music-playing application (e.g., browser-based application, native music player, other multimedia application, and so on) to a multimedia content playback (e.g., Sonos™) system. Certain embodiments provide simple, easy-to-use and secure systems and methods for multimedia content playback across a plurality of systems and locations. Certain embodiments facilitate integration between content partners and a playback system as well as supporting maintenance of such content and system.

Although the following discloses example systems, methods, apparatus, and articles of manufacture including, among other components, firmware and/or software executed on hardware, it should be noted that such systems, methods, apparatus, and/or articles of manufacture are merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all of these firmware, hardware, and/or software components could be embodied exclusively in hardware, exclusively in software, exclusively in firmware, or in any combination of hardware, software, and/or firmware. Accordingly, while the following describes example systems, methods, apparatus, and/or articles of manufacture, the examples provided are not the only way(s) to implement such systems, methods, apparatus, and/or articles of manufacture.

When any of the appended claims are read to cover a purely software and/or firmware implementation, at least one of the elements in at least one example is hereby expressly defined to include a tangible medium such as a memory, DVD, CD, Blu-ray, and so on, storing the software and/or firmware.

Reference herein to "embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one example embodiment of the invention. The appearances of this phrase in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. As such, the embodiments described herein, explicitly and implicitly understood by one skilled in the art, can be combined with other embodiments.

Certain embodiments provide a method to provide content to a local playback network. The example method includes identifying multimedia content from a content provider. The example method includes passing information regarding the multimedia content to a local playback system including one or more multimedia playback devices in response to a trigger. The example method includes facilitating play of the multimedia content via a local playback network associated with the local playback system.

Certain embodiments provide a computer readable storage medium including instructions for execution by a processor, the instructions, when executed, cause the processor to implement a method to provide content to a local playback network. The example method includes identifying multimedia content from a content provider. The example method includes passing information regarding the multimedia content to a local playback system including one or

more multimedia playback devices in response to a trigger. The example method includes facilitating play of the multimedia content via a local playback network associated with the local playback system.

Certain embodiments provide a multimedia playback device including a wireless communication interface to communicate with a local playback network and a multimedia content source and a processor. The process is to identify multimedia content from the multimedia content source; pass information regarding the multimedia content to device on the local playback network in response to a trigger; and facilitate play of the multimedia content via the devices on the local playback network.

II. Example Environment

Referring now to the drawings, in which like numerals can refer to like parts throughout the figures, FIG. **1** shows an example system configuration **100** in which one or more of the method and/or apparatus disclosed herein can be practiced or implemented. By way of illustration, the system configuration **100** represents a home with multiple zones. Each zone, for example, represents a different room or space, such as an office, bathroom, bedroom, kitchen, dining room, family room, home theater room, utility or laundry room, and patio. While not shown here, a single zone can cover more than one room or space. One or more of zone players **102-124** are shown in each respective zone. A zone player **102-124**, also referred to as a playback device, multimedia unit, speaker, and so on, provides audio, video, and/or audiovisual output. A controller **130** (e.g., shown in the kitchen for purposes of illustration) provides control to the system configuration **100**. The system configuration **100** illustrates an example whole house audio system, though it is understood that the technology described herein is not limited to its particular place of application or to an expansive system like a whole house audio system **100** of FIG. **1**.

FIGS. **2**A, **2**B, and **2**C show example illustrations of zone players **200-204**. The zone players **200-204** of FIGS. **2**A, **2**B, and **2**C, respectively, can correspond to any of the zone players **102-124** of FIG. **1**. While certain embodiments provide multiple zone players, an audio output can be generated using only a single zone player. FIG. **2**A illustrates a zone player **200** including sound producing equipment **208** capable of generating sound or an audio output corresponding to a signal received (e.g., wirelessly and/or via a wired interface). The sound producing equipment **208** of the zone player **200** of FIG. **2**A includes a built-in amplifier (not shown in this illustration) and speakers (e.g., a tweeter, a mid-range driver, and/or a subwoofer). In certain embodiments, the zone player **200** of FIG. **2**A can be configured to play stereophonic audio or monaural audio. In some embodiments, the zone player **200** of FIG. **2**A can be configured as a component in a combination of zone players to play stereophonic audio, monaural audio, and/or surround audio. As described in greater detail below, in some embodiments, the example zone player **200** of FIG. **2**A can also transmit a second signal to, for example, other zone player(s) in the same or different zone(s), speaker(s), receiver(s), and so on. Transmission of the second signal can be part of, for example, a system in which multiple zone players, speakers, receivers, and so on, form a network to, for example, present media content in a synchronization or distributed manner.

The example zone player **202** of FIG. **2**B includes a built-in amplifier (not shown in this illustration) to power a set of detached speakers **210**. The speakers **210** of FIG. **2**B can include, for example, any type of loudspeaker. The zone player **202** of FIG. **2**B can communicate a signal corresponding to audio content to the detached speakers **210** via wired and/or wireless channels. Instead of receiving and generating audio content as in FIG. **2**A, the zone player **202** of FIG. **2**B receives the audio content and transmits the same (e.g., after processing the received signal) to the detached speakers **210**. Similar to the example zone player **200** of FIG. **2**A, in some embodiments the zone player **202** can transmit a second signal to, for example, other zone player(s) in the same or different zone(s), speaker(s), receiver(s), and so on.

The example zone player **204** of FIG. **2**C does not include an amplifier, but allows a receiver **214**, or another audio and/or video type device with built-in amplification, to connect to a data network **128** of FIG. **1** and to play audio received over the data network **128** via the receiver **214** and a set of detached speakers **216**. In addition to the wired couplings shown in FIG. **2**C, the detached speakers **216** can receive audio content via a wireless communication channel between the detached speakers **216** and, for example, the zone player **204** and/or the receiver **214**. In some embodiments the zone player **202** can transmit a second signal to, for example, other zone player(s) in the same or different zone(s), speaker(s), receiver(s), and so on.

Example zone players include a "Sonos S5," "Sonos Play:5," "Sonos Play:3," "ZonePlayer 120," and "ZonePlayer 90," which are offered by Sonos, Inc. of Santa Barbara, Calif. Any other past, present, and/or future zone players can additionally or alternatively be used to implement the zone players of example embodiments disclosed herein. A zone player can also be referred to herein as a playback device, and a zone player is not limited to the particular examples illustrated in FIGS. **2**A, **2**B, and **2**C. For example, a zone player can include a wired or wireless headphone. In other examples, a zone player might include a subwoofer. In yet other examples, a zone player can include a sound bar. In an example, a zone player can include or interact with a docking station for an Apple iPod™ or similar device. In some embodiments, a zone player can relay one or more signals received from, for example, a first zone player to another playback device. In some embodiments, a zone player can receive a first signal and generate an output corresponding to the first signal and, simultaneously or separately, can receive a second signal and transmit or relay the second signal to another zone player(s), speaker(s), receiver(s), and so on. Thus, an example zone player described herein can act as a playback device and, at the same time, operate as a hub in a network of zone players. In such instances, media content corresponding to the first signal can be different from the media content corresponding to the second signal.

FIG. **3** shows an example illustration of a wireless controller **300** in a docking station **302**. The controller **300** can correspond to the controlling device **130** of FIG. **1**. The controller **300** is provided with a touch screen **304** that allows a user to interact with the controller **300**, for example, to retrieve and navigate a playlist of audio items, control operations of one or more zone players, and provide overall control of the system configuration **100**. In certain embodiments, any number of controllers can be used to control the system configuration **100**. In certain embodiments, there can be a limit on the number of controllers that can control the system configuration **100**. The controllers might be wireless like wireless controller **300** or wired to the data network **128**. Furthermore, an application running on any network-enabled portable devices, such as an iPhone™ iPad™

Android™ powered phone, or any other smart phone or network-enabled device can be used as a controller by connecting to the data network **128**. An application running on a laptop or desktop PC or Mac can also be used as a controller. Example controllers include a "Sonos® Controller 200," "Sonos® Controller for iPhone," "Sonos® Controller for iPad," "Sonos® Controller for Android, "Sonos® Controller for Mac or PC," which are offered by Sonos, Inc. of Santa Barbara, Calif. The flexibility of such an application and its ability to be ported to a new type of portable device is advantageous.

Referring back to the system configuration **100** of FIG. **1**, a particular zone can contain one or more zone players. For example, the family room of FIG. **1** contains two zone players **106** and **108**, while the kitchen is shown with one zone player **102**. Zones can be dynamically configured by positioning a zone player in a room or space and assigning via the controller **130** the zone player to a new or existing zone. As such, zones can be created, combined with another zone, removed, and given a specific name (e.g., "Kitchen"), if so programmed. The zone players **102** to **124** are coupled directly or indirectly to a data network, such as the data network **128** shown in FIG. **1**. The data network **128** is represented by an octagon in the figure to stand out from other components shown in the figure. While the data network **128** is shown in a single location, it is understood that such a network can be distributed in and around the system configuration **100**.

Particularly, the data network **128** can be a wired network, a wireless network, or a combination of both. In some embodiments, one or more of the zone players **102-124** are wirelessly coupled to the data network **128** based on a proprietary mesh network. In some embodiments, one or more of the zone players **102-124** are wirelessly coupled to the data network **128** using a non-mesh topology. In some embodiments, one or more of the zone players **102-124** are coupled via a wire to the data network **128** using Ethernet or similar technology. In addition to the one or more zone players **102-124** connecting to the data network **128**, the data network **128** can further allow access to a wide area network, such as the Internet.

In certain embodiments, the data network **128** can be created by connecting any of the zone players **102-124**, or some other connecting device, to a broadband router. Other zone players **102-124** can then be added wired or wirelessly to the data network **128**. For example, a zone player (e.g., any of zone players **102-124**) can be added to the system configuration **100** by simply pressing a button on the zone player itself, which enables a connection to be made to the data network **128**. The broadband router can be connected to an Internet Service Provider (ISP), for example. The broadband router can be used to form another data network within the system configuration **100**, which can be used in other applications (e.g., web surfing). The data network **128** can also be used in other applications, if so programmed. Further, in certain embodiments, the data network **128** is the same network used for other applications in the household.

In certain embodiments, each zone can play from the same audio source as another zone or each zone can play from a different audio source. For example, someone can be grilling on the patio and listening to jazz music via zone player **124**, while someone is preparing food in the kitchen and listening to classical music via zone player **102**. Further, someone can be in the office listening to the same jazz music via zone player **110** that is playing on the patio via zone player **124**. In some embodiments, the jazz music played via zone players **110** and **124** is played in synchrony. Synchronizing playback amongst zones allows for someone to pass through zones while seamlessly listening to the audio. Further, zones can be put into a "party mode" such that all associated zones will play audio in synchrony.

In certain embodiments, a zone contains two or more zone players. For example, the family room contains two zone players **106** and **108**, and the home theater room contains at least zone players **116**, **118**, and **120**. A zone can be configured to contain as many zone players as desired, and for example, the home theater room might contain additional zone players to play audio from a 5.1 channel or greater audio source (e.g., a movie encoded with 5.1 or greater audio channels). If a zone contains two or more zone players, such as the two zone players **106** and **108** in the family room, then the two zone players **106** and **108** can be configured to play the same audio source in synchrony, or the two zone players **106** and **108** can be paired to play two separate sounds in left and right channels, for example. In other words, the stereo effects of a sound can be reproduced or enhanced through the two zone players **106** and **108**, one for the left sound and the other for the right sound. In certain embodiments, paired zone players can play audio in synchrony with other zone players.

In certain embodiments, three or more zone players can be configured to play various channels of audio that is encoded with three channels or more sound. For example, the home theater room shows zone players **116**, **118**, and **120**. If the sound is encoded as 2.1 channel audio, then the zone player **116** can be configured to play left channel audio, the zone player **118** can be configured to play right channel audio, and the zone player **120** can be configured to play bass frequencies. Other configurations are possible and depend on the number of zone players and the type of audio. Further, a particular zone can be configured to play a 5.1 channel audio in one instance, such as when playing audio from a movie, and then dynamically switch to play stereo, such as when playing audio from a two channel source.

In certain embodiments, two or more zone players can be sonically consolidated to form a single, consolidated zone player. A consolidated zone player (though made up of multiple, separate devices) can be configured to process and reproduce sound differently than an unconsolidated zone player or zone players that are paired, because a consolidated zone player will have additional speaker drivers from which sound can be passed. The consolidated zone player can further be paired with a single zone player or yet another consolidated zone player. Each playback device of a consolidated playback device is preferably set in a consolidated mode.

According to some embodiments, one can continue to do any of: group, consolidate, and pair zone players, for example, until a desired configuration is complete. The actions of grouping, consolidation, and pairing are preferably performed through a control interface, such as using controller **130**, and not by physically connecting and reconnecting speaker wire, for example, to individual, discrete speakers to create different configurations. As such, certain embodiments described herein provide a more flexible and dynamic platform through which sound reproduction can be offered to the end-user.

Sources of audio content to be played by zone players **102-124** are numerous. Music from a personal library stored on a computer or networked-attached storage (NAS) can be accessed via the data network **128** and played. Internet radio stations, shows, and podcasts can be accessed via the data network **128**. Music services that let a user stream and download music and audio content can be accessed via the

data network **128**. Further, music can be obtained from traditional sources, such as a turntable or CD player, via a line-in connection to a zone player, for example. Audio content can also be accessed through AirPlay™ wireless technology by Apple, Inc., for example. Audio content received from one or more sources can be shared amongst the zone players **102** to **124** via the data network **128** and/or the controller **130**. The above-disclosed sources of audio content are referred to herein as network-based audio information sources. However, network-based audio information sources are not limited thereto.

The example home theater zone players **116**, **118**, **120** are coupled to an audio information source such as a television **132**. In some examples, the television **132** is used as a source of audio for the home theater zone players **116**, **118**, **120**, while in other examples audio information from the television **132** can be shared with any of the zone players **102-124** in the audio system **100**.

III. Example Playback Device

Referring now to FIG. **4**, there is shown an example functional block diagram of a zone player **400** in accordance with an embodiment. The zone player **400** of FIG. **4** includes a network interface **402**, a processor **408**, a memory **410**, an audio processing component **412**, a module **414**, an audio amplifier **416**, and a speaker unit **418** coupled to the audio amplifier **416**. FIG. **2**A shows an example illustration of such a zone player. Other types of zone players can not include the speaker unit **418** (e.g., such as shown in FIG. **2**B) or the audio amplifier **416** (e.g., such as shown in FIG. **2**C). Further, it is contemplated that the zone player **400** can be integrated into another component. For example, the zone player **400** could be constructed as part of a lamp for indoor or outdoor use.

Referring back to FIG. **4**, the network interface **402** facilitates a data flow between zone players and other devices on a data network (e.g., the data network **128** of FIG. **1**) and the zone player **400**. In some embodiments, the network interface **402** can manage the assembling of an audio source or file into smaller packets that are to be transmitted over the data network or reassembles received packets into the original source or file. In some embodiments, the network interface **402** can further handle the address part of each packet so that it gets to the right destination or intercepts packets destined for the zone player **400**. Accordingly, in certain embodiments, each of the packets includes an Internet Protocol (IP)-based source address as well as an IP-based destination address.

In some embodiments, the network interface **402** can include one or both of a wireless interface **404** and a wired interface **406**. The wireless interface **404**, also referred to as an RF interface, provides network interface functions for the zone player **400** to wirelessly communicate with other devices (e.g., other zone player(s), speaker(s), receiver(s), component(s) associated with the data network **128**, and so on) in accordance with a communication protocol (e.g., any of the wireless standards IEEE 802.11a, 802.11b, 802.11g, 802.11n, or 802.15). To receive wireless signals and to provide the wireless signals to the wireless interface **404** and to transmit wireless signals, the zone player **400** of FIG. **4** includes one or more antennas **420**. The wired interface **406** provides network interface functions for the zone player **400** to communicate over a wire with other devices in accordance with a communication protocol (e.g., IEEE 802.3). In some embodiments, a zone player includes both of the interfaces **404** and **406**. In some embodiments, a zone player **400** includes only the wireless interface **404** or the wired interface **406**.

In some embodiments, the processor **408** is a clock-driven electronic device that is configured to process input data according to instructions stored in memory **410**. The memory **410** is data storage that can be loaded with one or more software modules **414**, which can be executed by the processor **408** to achieve certain tasks. In the illustrated embodiment, the memory **410** is a tangible machine readable medium storing instructions that can be executed by the processor **408**. In some embodiments, a task might be for the zone player **400** to retrieve audio data from another zone player or a device on a network. In some embodiments, a task might be for the zone player **400** to send audio data to another zone player or device on a network. In some embodiments, a task might be for the zone player **400** to synchronize playback of audio with one or more additional zone players. In some embodiments, a task might be to pair the zone player **400** with one or more zone players to create a multi-channel audio environment. Additional or alternative tasks can be achieved via the one or more software modules **414** and the processor **408**.

The audio processing component **412** can include one or more digital-to-analog converters (DAC), an audio preprocessing component, an audio enhancement component or a digital signal processor, and so on. In certain embodiments, the audio that is retrieved via the network interface **402** is processed and/or intentionally altered by the audio processing component **412**. Further, the audio processing component **412** can produce analog audio signals. The processed analog audio signals are then provided to the audio amplifier **416** for play back through speakers **418**. In addition, the audio processing component **412** can include necessary circuitry to process analog or digital signals as inputs to play from zone player **400**, send to another zone player on a network, or both play and send to another zone player on the network. An example input includes a line-in connection (e.g., an auto-detecting 3.5 mm audio line-in connection).

The audio amplifier **416** is a device that amplifies audio signals to a level for driving one or more speakers **418**. The one or more speakers **418** can include an individual transducer (e.g., a "driver") or a complete speaker system that includes an enclosure including one or more drivers. A particular driver can be a subwoofer (for low frequencies), a mid-range driver (middle frequencies), and a tweeter (high frequencies), for example. An enclosure can be sealed or ported, for example.

A zone player **400** can also be referred to herein as a playback device. An example playback device includes a Sonos® Play:5, which is manufactured by Sonos, Inc. of Santa Barbara, Calif. The Play:5 is an example zone player with a built-in amplifier and speakers. In particular, the Play:5 is a five-driver speaker system that includes two tweeters, two mid-range drivers, and one subwoofer. When playing audio content via the Play:5, the left audio data of a track is sent out of the left tweeter and left mid-range driver, the right audio data of a track is sent out of the right tweeter and the right mid-range driver, and mono bass is sent out of the subwoofer. Further, both mid-range drivers and both tweeters have the same equalization (or substantially the same equalization). That is, they are both sent the same frequencies, just from different channels of audio. Audio from Internet radio stations, online music and video services, downloaded music, analog audio inputs, television, DVD, and so on, can be played from a Sonos® Play:5. While the Play:5 is an example of a zone player with

speakers, it is understood that a zone player with speakers is not limited to one with a certain number of speakers (e.g., five speakers as in the Play:5), but rather can contain one or more speakers. Further, a zone player can be part of another device, which might even serve a purpose different than audio (e.g., a lamp).

IV. Example Controller

Referring now to FIG. **5**, there is shown an example controller **500**, which can correspond to the controlling device **130** in FIG. **1**. The controller **500** can be used to facilitate the control of multi-media applications, automation and others in a system. In particular, the controller **500** is configured to facilitate a selection of a plurality of audio sources available on the network and enable control of one or more zone players (e.g., the zone players **102-124** in FIG. **1**) through a wireless network interface **508**. According to one embodiment, the wireless communications is based on an industry standard (e.g., infrared, radio, wireless standards IEEE 802.11a, 802.11b 802.11g, 802.11n, or 802.15). Further, when a particular audio is being accessed via the controller **500** or being played via a zone player, a picture (e.g., album art) or any other data, associated with the audio source can be transmitted from a zone player or other electronic device to the controller **500** for display.

The controller **500** is provided with a screen **502** and an input interface **514** that allows a user to interact with the controller **500**, for example, to navigate a playlist of many multimedia items and to control operations of one or more zone players. The screen **502** on the controller **500** can be an LCD screen, for example. The screen **500** communicates with and is commanded by a screen driver **504** that is controlled by a microcontroller (e.g., a processor) **506**. The memory **510** can be loaded with one or more application modules **512** that can be executed by the microcontroller **506** with or without a user input via the user interface **514** to achieve certain tasks. In some embodiments, an application module **512** is configured to facilitate grouping a number of selected zone players into a zone group and synchronizing the zone players for audio play back. In some embodiments, an application module **512** is configured to control the audio sounds (e.g., volume) of the zone players in a zone group. In operation, when the microcontroller **506** executes one or more of the application modules **512**, the screen driver **504** generates control signals to drive the screen **502** to display an application specific user interface accordingly.

The controller **500** includes a network interface **508** that facilitates wireless communication with a zone player. In some embodiments, the commands such as volume control and audio playback synchronization are sent via the network interface **508**. In some embodiments, a saved zone group configuration is transmitted between a zone player and a controller via the network interface **508**. The controller **500** can control one or more zone players, such as **102-124** of FIG. **1**. There can be more than one controller for a particular system. Further, a controller can be integrated into a zone player.

It should be noted that other network-enabled devices such as an iPhone®, iPad® or any other smart phone or network-enabled device (e.g., a networked computer such as a PC or Mac®) can also be used as a controller to interact or control zone players in a particular environment. In some embodiments, a software application or upgrade can be downloaded onto a network enabled device to perform the functions described herein.

In certain embodiments, a user can create a zone group including at least two zone players from the controller **500**. The zone players in the zone group can play audio in a synchronized fashion, such that all of the zone players in the zone group play back an identical audio source or a list of identical audio sources in a synchronized manner such that no (or substantially no) audible delays or hiccups could be heard. Similarly, in some embodiments, when a user increases the audio volume of the group from the controller **500**, the signals or data of increasing the audio volume for the group are sent to one of the zone players and causes other zone players in the group to be increased together in volume.

A user via the controller **500** can group zone players into a zone group by activating a "Link Zones" or "Add Zone" soft button, or de-grouping a zone group by activating an "Unlink Zones" or "Drop Zone" button. For example, one mechanism for 'joining' zone players together for audio play back is to link a number of zone players together to form a group. To link a number of zone players together, a user can manually link each zone player or room one after the other. For example, assume that there is a multi-zone system that includes the following zones: Bathroom, Bedroom, Den, Dining Room, Family Room, and Foyer.

In certain embodiments, a user can link any number of the six zone players, for example, by starting with a single zone and then manually linking each zone to that zone.

In certain embodiments, a set of zones can be dynamically linked together using a command to create a zone scene or theme (subsequent to first creating the zone scene). For instance, a "Morning" zone scene command can link the Bedroom, Office, and Kitchen zones together in one action. Without this single command, the user would need to manually and individually link each zone. The single command might include a mouse click, a double mouse click, a button press, a gesture, or some other programmed action. Other kinds of zone scenes can be programmed.

In certain embodiments, a zone scene can be triggered based on time (e.g., an alarm clock function). For instance, a zone scene can be set to apply at 8:00 am. The system can link appropriate zones automatically, set specific music to play, and then stop the music after a defined duration. Although any particular zone can be triggered to an "On" or "Off" state based on time, for example, a zone scene enables any zone(s) linked to the scene to play a predefined audio (e.g., a favorable song, a predefined playlist) at a specific time and/or for a specific duration. If, for any reason, the scheduled music failed to be played (e.g., an empty playlist, no connection to a share, failed Universal Plug and Play (UPnP), no Internet connection for an Internet Radio station, and so on), a backup buzzer can be programmed to sound. The buzzer can include a sound file that is stored in a zone player, for example.

V. Example Ad-Hoc Network

Certain particular examples will now be provided in connection with FIGS. **6-8**B to describe, for purposes of illustration only, certain base systems and methods to provide and facilitate connection to a playback network. FIG. **6** shows that there are three zone players **602**, **604** and **606** and a controller **608** that form a network branch that is also referred to as an Ad-Hoc network **610**. The network **610** may be wireless, wired, or a combination of wired and wireless. In general, an Ad-Hoc (or "spontaneous") network is a local area network or other small network in which there is no one access point for all traffic. With an established Ad-Hoc network **610**, the devices **602**, **604**, **606** and **608** can all

communicate with each other in a "peer-to-peer" style of communication, for example. Furthermore, devices may come/and go from the network **610**, and the network **610** will automatically reconfigure itself without needing the user to reconfigure the network **610**.

Using the Ad-Hoc network **610**, the devices **602**, **604**, **606**, and **608** can share or exchange one or more audio sources and be grouped to play the same or different audio sources. For example, the devices **602** and **604** are grouped to playback one piece of music, and at the same time, the device **606** plays back another piece of music. In other words, the devices **602**, **604**, **606** and **608**, as shown in FIG. **6**, form a HOUSEHOLD that distributes audio and/or reproduces sound. As used herein, the term HOUSEHOLD (provided in uppercase letters to disambiguate from the user's domicile) is used to represent a collection of networked devices that are cooperating to provide an application or service. An instance of a HOUSEHOLD is identified with a household **10** (or household identifier).

In certain embodiments, a household identifier (HHID) is a short string or an identifier that is computer-generated to help ensure that it is unique. Accordingly, the network **610** can be characterized by a unique HHID and a unique set of configuration variables or parameters, such as channels (e.g., respective frequency bands), SSID (a sequence of alphanumeric characters as a name of a wireless network), and WEP keys (wired equivalent privacy or other security keys). In certain embodiments, SSID is set to be the same as HHID.

In certain embodiments, each HOUSEHOLD includes two types of network nodes: a control point (CP) and a zone player (ZP). The control point controls an overall network setup process and sequencing, including an automatic generation of required network parameters (e.g., WEP keys). In an embodiment, the CP also provides the user with a HOUSEHOLD configuration user interface. The CP function can be provided by a computer running a CP application module, or by a handheld controller (e.g., the controller **308**) also running a CP application module, for example. The zone player is any other device on the network that is placed to participate in the automatic configuration process. The ZP, as a notation used herein, includes the controller **308** or a computing device, for example.

In certain embodiments, configuration of a HOUSEHOLD involves multiple CPs and ZPs that rendezvous and establish a known configuration such that they can use a standard networking protocol (e.g., IP over Wired or Wireless Ethernet) for communication. In an embodiment, two types of networks/protocols are employed: Ethernet 802.3 and Wireless 802.11g. Interconnections between a CP and a ZP can use either of the networks/protocols. A device in the system as a member of a HOUSEHOLD can connect to both networks simultaneously. In an environment that has both networks in use, it is assumed that at least one device in a system is connected to both as a bridging device, thus providing bridging services between wired/wireless networks for others. The zone player **606** in FIG. **6** is shown to be connected to both networks, for example. The connectivity to the network **612** is based on Ethernet while the connectivity to other devices **602**, **604** and **608** is based on Wireless. It is understood, however, that in some embodiments each zone player **606**, **604**, **602** may access the Internet when retrieving media from the cloud (e.g., Internet) via the bridging device. For example, zone player **602** may contain a uniform resource locator (URL) that specifies an address to a particular audio track in the cloud. Using the URL, the zone player **602** may retrieve the audio track from the cloud, and ultimately play the audio out of one or more zone players.

VI. Example Music Sharing and Playback Configuration

Certain embodiments enable a user to stream music from a music-playing application (e.g., browser-based application, native music player, other multimedia application, and so on) to a local multimedia content playback (e.g., Sonos™) system. Certain embodiments provide secure systems and methods for multimedia content playback across a plurality of systems and locations. Certain embodiments facilitate integration between content partners and a playback system as well as supporting maintenance of such content and system.

FIG. **7** shows a system including a plurality of networks including a cloud-based network and at least one local playback network. The network includes a plurality of playback devices or players, though it is understood that the network may contain only one playback device. In certain embodiments, each player has an ability to retrieve its content for playback. Control and content retrieval can be distributed or centralized, for example. Input can include streaming content provider input, third party application input, mobile device input, user input, and/or other playback network input into the cloud for local distribution and playback.

As illustrated by the example system **700** of FIG. **7**, a plurality of content providers **720-750** can be connected to one or more local playback networks **760-770** via a cloud and/or other network **710**. Using the cloud **710**, a multimedia playback system **720** (e.g., Sonos™), a mobile device **730**, a third party application **740**, a retail location **750**, and so on can provide multimedia content (requested or otherwise) to local playback networks **760**, **770**. Within each local network **760**, **770**, a controller **762**, **772** and/or playback device **764**, **774** can provide a song identifier, song name, playlist identifier, playlist name, genre, preference, and so on, and/or simply receive content from a connected system via the cloud.

For example, a user listens to a third party music application (e.g., Pandora™ Rhapsody™, Spotify™, and so on) on her smart phone while commuting. She's enjoying the current channel and, as she walks in the door to her home, selects an option to continue playing that channel on her household music playback system (e.g., Sonos™). The playback system picks up from the same spot on the selected channel that was on her phone and outputs that content (e.g., that song) on speakers and/or other playback devices connected to the household playback system. A uniform resource indicator (URI) (e.g., a uniform resource locator (URL)) can be passed to a playback device to fetch content from a cloud and/or other networked source, for example. A playback device, such as a zone player, can fetch content on its own without use of a controller, for example. Once the zone player has a URL (or some other identification or address) for a song and/or playlist, the zone player can run on its own to fetch the content. Songs and/or other multimedia content can be retrieved from the Internet rather than a local device (e.g., a compact disc (CD)), for example. A third party application can open or utilize an application programming interface (API) to pass music to the household playback system without tight coupling to that household playback system.

In another example of an application determining a playlist and/or other content for playback, a user enjoys listening to music on an online music service (e.g., turntable.fm or other virtual room that a user can enter to choose from a plurality of online disc jockeys (DJs) deciding what to play next) using his Mac Book Pro™ at home. He likes the unique user experience the service offers, and he frequently hops from room to room discovering new music. To maximize sound quality, he plays the music on his household playback system (e.g., Sonos™). A button or other indicator can be added to the turntable.fm Web application to switch the content being played to the playback system for output (e.g., to the Sonos™ system rather than or in addition to the Mac Book™). While Web-based applications typically do not have access to items on a local network, certain embodiments enable a third-party Web-based application (e.g., Turntable.fm) to talk to a playback system (e.g., Sonos™) in a certain way (e.g., may have to log in with a username and password), and the identified user has the website send audio or audio and video down to a playback device (e.g., a zone player) on the playback system local network to play music there (or some other media).

In another example, a first user creates a playlist (e.g., a Spotify™ playlist). The first user visits a second user's house, pulls out her smart phone and shares her playlist by playing it on the second user's household playback (e.g., Sonos™) system using her third party (e.g., Spotify™) application. The first user may also go to the third party content provider's (e.g., Spotify's™) website and share her playlist on the second user's playback system.

Thus, certain embodiments provide cross-service linking such that a song identifier can be passed from one user and/or service to another to be fetched and played. A user having a playlist on his or her phone can visit a friend and, using her account on her friend's system, play a song to which she has an access right. A retrieved song can streamed locally to a user's phone, or an application can pass a song identifier to a local playback system which looks up the song identifier and finds an available audio stream to which the user has a right to play and then plays that song.

In another example, a user is staying in a hotel room or other facility including a local playback network. For example, a speaker and/or other playback device (e.g., a Sonos™ Play:3, Play: 5 and so on) in a hotel room can be utilized to play multimedia content to which the user has access from his or her playback network account, streaming audio source, third party application, and so on. Content can be output to one or more devices based on availability, access, configuration, priority, preference, and so on. In certain embodiments, a playback network includes a plurality of nodes, and each node has a capability to play sound in response to an input. Requested output is provided to a most logical connection, for example.

In certain embodiments, a phone device, a television device, and so on can be used to play music, audio, video and/or other multimedia content. In an example, a push button on a microphone or household intercom system to tell the kids dinner is ready is provided over the local playback network.

FIG. **8** shows a flow diagram for a method **800** to provide audio content to a local playback system. In the example method **800** of FIG. **8**, a third party application acts as a "virtual line-in" to the local playback system. At block **810**, streaming of music or other content from a third party application to a local content playback system is triggered. For example, a "Play to Sonos" button is pressed on a Rhapsody™ application. At block **820**, content is streamed to one or more components in a household playback network. The music may be streamed to predetermined zones or players in a household, for example. The music may be further directed to be played in different zones or players throughout the household. Playback on the local network can be facilitated to one or more zones/players based on a configuration (e.g., a zone scene, theme, and so on). Thus, certain embodiments allow a large degree of flexibility in where the music is actually played. For example, the music can be played in the kitchen, the family room, the patio, and so on. Further, the music may be redirected to different zones.

At block **830**, the incoming content (e.g., audio) stream is provided directly from a third party application or other external source to the local playback network for playback. For example, rather than passing track identifiers, an audio stream is provided to a Sonos household system for playback to one or more configured zones. At block **840**, the local playback system consumes the stream and plays it as it would other content on the local playback (e.g., Sonos™) network (e.g., via zones and so on). At block **850**, a playback device (e.g., a zone player, Play:3™, Play:5™, and so on) adds timing information to the streaming content signal (e.g., the device takes the streaming audio signal and repackages it for local synchronized playback). In some embodiments, timing information is not added to the signal unless two or more playback devices are configured to play the audio in synchrony.

FIG. **9** shows a flow diagram for a method **900** to provide audio content to a local playback system. In the example method **900** of FIG. **9**, a uniform resource indicator (URI) handler approach is provided for content output. At block **910**, a link or other reference is embedded in a third party application (e.g., Facebook™ or Twitter). At block **920**, when the link is selected (e.g., clicked), a local playback (e.g., Sonos™) controller, if available, is launched. At block **930**, the application (e.g., accessed on a phone, tablet, computer, and so on) passes a URI for associated content (e.g., an audio track and so on) to a local playback system (e.g., Sonos™) controller. At block **940**, the local controller outputs the associated content (e.g., plays the music) via the URI. For example, music is streamed from the cloud to one or more playback devices on the local playback network.

In certain embodiments, an application associated with the operating system can register to handle all URIs (URLs) that start with a certain prefix and can define how data is encoded into those URLs so a local playback system application can generate a link (e.g., "sonos:") and put that link into a message (e.g., email, text message, instant message (IM), etc.). The local playback application registered to handle such URLs can parse the URLs to determine what song, playlist, streaming radio station, etc., to play. This launches the controller application. For example, if a first listener likes a song and tweets that song, Twitter™ can include a clickable link which launches a playback application and starts the music playing on a local playback system if the local system can find the song (e.g., if have the application, if have rights/access to the song, etc.). In certain embodiments, the system knows to trigger the receiving user's system rather than the sending user's system to play associated content based on the transmitted link/identifier.

For example, an application can register with the system to handle all URLs that start with a custom prefix (e.g., an HTTP "scheme"). For instance, Sonos controller apps can register to handle any URL that begins with "sonos:" or "x-sonos:". In certain embodiments, a playback system provider can define and publish the format of its URLs so

that any third party application can create a link or reference to content. A large amount of data can be encoded into a URL using query parameters, for example.

In an example, when an application tries to "open" or "browse" to a URL, the system checks to see if the scheme of the URL matches the "sonos:" scheme that has been registered with the application. If a URL handler application is found, the system launches that application (e.g., the application can but does not need to be running in the background) and passes the URL to the application. The application then parses the URL and executes functionality based on the data in the URL. For example, the URL can contain the name of a music service and a playlist identifier from that service, plus the name of a Sonos™ Zone Player, causing the Sonos controller to start that playlist playing on that zone.

FIG. **10** shows a flow diagram for a method **1000** to provide audio content to a local playback system. In the example method **1000** of FIG. **10**, at block **1010**, a link or other reference is embedded in a third party application (e.g., Facebook™). At block **1020**, when the link is selected, a playback system (e.g., Sonos™) server is contacted and provided with information regarding selected content for playback. For example, rather than launching a local controller application, a server is contacted regarding music for playback on a local network. At block **1030**, using the provided information, the server identifies and provides the content locally on a user's local playback system. For example, the server can then start playing the music directly on the user's Sonos™ system (e.g., without going through a Sonos™ controller application).

In certain embodiments, a "single sign-on" technology is provided so that the user does not need to re-enter a username and password in order to authenticate to the playback server. Example single sign-on technologies include Facebook Connect™, Windows Live ID™, etc.

In certain embodiments, instead of using a specialized link, such as a "sonos:" link, a normal URL can be used to point to a playback system (e.g., Sonos™) webserver, which generates links with special data embedded in the link. A playback system is identified, and content identified by the URL can be playing at via the local playback network (e.g., mesh network configured for home, hotel room, etc.). Parameters such as authentication, security, location, and so on can be configured for local playback of remote content.

FIG. **11** shows a flow diagram for a method **1100** to provide audio content to a local playback system. The example method **1100** of FIG. **11** provides a "throw it over the wall" approach to content delivery to a local playback system. At block **1110**, a third party application provides a multimedia playback device (e.g., a Sonos™ zone player (ZP)) with enough information about content (e.g., an audio track) so that, at block **1120**, the local playback system (e.g., SonosNet™) can directly access a source of the content and, at block **1130**, play the content directly off the network (e.g., the Internet) or cloud.

In certain embodiments, a local playback controller application is not involved. Information passed over to the local playback device may include an identifier for a single track, a playlist, a streaming radio station, a programmed radio station, and so on. This information can also include a current play position within a list to enable near-seamless "handoff" of music from a portable device to a local playback system. Once the music information is handed from the third-party application to the local playback system, there is no further synchronization between the two systems.

A connection between the third-party application and the local playback device (e.g., Sonos ZonePlayer™) can be direct over a local area network (LAN), remote through a proxy server in the cloud, and so on. A LAN delivery approach may be easier to integrate into "native" applications (e.g., applications written for iOS or Android), and a proxy server approach may be easier for third party applications that are browser-based, for example.

In certain embodiments, information is provided from a third party application to a local playback system without being routed through or by a controller application. Here, the third party application is communicating with the multimedia playback device (e.g., a Sonos ZonePlayer™). Information can be passed locally, rather than through the Internet, for example. The local playback device accesses the Internet to find content to stream, and the third party application takes the place of the controller application (e.g., throw it over the wall—the application passes information and the local playback system runs it).

Certain embodiments provide an approach similar to the "throw it over the wall" or one way communication approach of FIG. **11** except that the third party application not only tells the local playback system what to play, but also maintains two-way communication with the local playback (e.g., Sonos™) system. Two-way communication helps enable features such as keeping a local playback queue synchronized with a queue that the user is editing/managing in the third party application; allow the third party application to know what is currently playing on the local playback system; allow integrated transport control between the third party application and the local playback system; and so on.

In certain embodiments, a local playback system can pass information back to a third party application to indicate a current point of playback (e.g., now playing a third song in a playlist, fourth song in the playlist, and so on). The local playback system can pass parameter information, such as a change in volume, from a local multimedia playback device to the third party application so the application can reflect the change in volume to the user via its graphical user interface. The third party application can instruct the local playback system to skip a song, go to a certain location, and so on.

Certain embodiments provide a third party mode that allows users to select from any local playback network (e.g., Sonos™) controller to listen to audio from one or more third party applications on their smartphones or tablets (e.g., Android™ devices). For example, a user may be using a local playback network controller application and now wants a third party application to appear as an audio source within the controller application. The user can then select the controller application that he or she wishes to play audio from the third party application, for example.

Certain embodiments provide queue management to allow a third party application to control a local playback queue. That is, the local playback system has a queue, but the third party application allows users to add, delete and so on from the queue, for example. Rather than switch from content that the user is currently playing, the local playback system allows a user to create a playlist on the fly. For example, if last.fm users vote that they do not like a song and it should be skipped, then the local playback system will skip it.

Certain embodiments allow a third party application to override a local playback queue with its own application-specific queue. The local playback system periodically fetches a short list of tracks to play next. The list of tracks to play is determined by the third-party application, for

example. In certain embodiments, a shared queue is provided between the local playback system and the third party application to keep the local system and application synchronized.

Certain embodiments allow control of playback system functions and/or settings via an external (e.g., third party) application. For example, a local playback system can allow volume control, play/pause, and so on and can interact with an application running on a given platform/operating system (OS). Certain embodiments provide a Web API that can be used to access functionality.

Certain embodiments facilitate control of a local playback system from outside a household or other location at which the local playback network is configured. For example, a user can queue up music while away from his or her house. The application can facilitate setup and/or configuration. For example, a third party application may ask the user to enter a Sonos customer email address and password. The application can then make a request to a Sonos server in the cloud to determine the zone groups on which music can be played.

Various inventions have been described in sufficient detail with a certain degree of particularity. It is understood to those skilled in the art that the present disclosure of embodiments has been made by way of examples only and that numerous changes in the arrangement and combination of parts can be resorted without departing from the spirit and scope of the present disclosure as claimed. While the embodiments discussed herein can appear to include some limitations as to the presentation of the information units, in terms of the format and arrangement, the embodiments have applicability well beyond such embodiment, which can be appreciated by those skilled in the art. Accordingly, the scope of the present disclosure is defined by the appended claims rather than the forgoing description of embodiments.

The invention claimed is:

1. A method comprising:

causing, via a control device, a graphical interface to display a control interface including one or more transport controls to control playback by the control device;

after connecting to a local area network via a network interface, identifying, via the control device, playback devices connected to the local area network;

causing, via the control device, the graphical interface to display a selectable option for transferring playback from the control device;

detecting, via the control device, a set of inputs to transfer playback from the control device to a particular playback device, wherein the set of inputs comprises: (i) a selection of the selectable option for transferring playback from the control device and (ii) a selection of the particular playback device from the identified playback devices connected to the local area network;

after detecting the set of inputs to transfer playback from the control device to the particular playback device, causing playback to be transferred from the control device to the particular playback device, wherein transferring playback from the control device to the particular playback device comprises:

(a) causing one or more first cloud servers to add multimedia content to a local playback queue on the particular playback device, wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service;

(b) causing playback at the control device to be stopped; and

(c) modifying the one or more transport controls of the control interface to control playback by the playback device; and

causing the particular playback device to play back the multimedia content, wherein the particular playback device playing back the multimedia content comprises the particular playback device retrieving the multimedia content from one or more second cloud servers of a streaming content service and playing back the retrieved multimedia content.

2. The method of claim **1**, wherein detecting the set of inputs to transfer playback from the control device to the particular playback device comprises detecting a set of inputs to transfer playback from the control device to a particular zone of a media playback system that includes the particular playback device as a first channel of a stereo pair and an additional playback device as a second channel of the stereo pair, wherein modifying the one or more transport controls of the control interface to control playback by the particular playback device comprises causing the one or more transport controls of the control interface to control playback by the particular playback device and the additional playback device, and wherein the particular playback device playing back the retrieved multimedia content comprises the particular playback device and the additional playback device playing back the multimedia content as the stereo pair.

3. The method of claim **1**, wherein detecting the set of inputs to transfer playback from the control device to the particular playback device comprises detecting a set of inputs to transfer playback from the control device to a particular zone group of a media particular playback system that includes a first zone and a second zone, wherein the first zone includes the particular playback device and the second zone includes at least one additional playback device, wherein modifying the one or more transport controls of the control interface to control playback by the playback device comprises causing the one or more transport controls of the control interface to control playback by the particular playback device and the at least one additional playback device in synchrony, and wherein the particular playback device playing back the retrieved multimedia content comprises the particular playback device and the at least one additional playback device playing back the multimedia content in synchrony.

4. The method of claim **1**, wherein the control interface is displayed by an application associated with the streaming content service, and wherein the set of inputs further comprises detecting an input to select a link in the application associated with the streaming content service and wherein selection of the link launches a second application to facilitate retrieving the multimedia content by the particular playback device from a particular source indicated by a resource locator.

5. The method of claim **1**, wherein the control interface is displayed by an application associated with the streaming content service, and wherein the set of inputs further comprises detecting an input to select a link in the application associated with the streaming content service and wherein selection of the link causes the control device to transmit information to the one or more first cloud servers to add multimedia content to the local playback queue on the particular playback device.

6. The method of claim **1**, further comprising detecting, via the control device, a set of inputs to transfer playback

from the playback device back to the control device, wherein transferring playback from the playback device back to the control device comprises:

causing playback at the playback device to be stopped; and

modifying the one or more transport controls of the control interface to control playback by the control device.

7. The method of claim **1**, wherein causing the graphical interface to display the control interface including one or more transport controls to control playback by the control device comprises causing the graphical interface to display a control interface that includes the one or more transport controls in a particular arrangement on the graphical interface, and wherein modifying the one or more transport controls of the control interface to control playback by the particular playback device comprises causing the graphical interface to display the one or more transport controls to control playback by the particular playback device in the particular arrangement.

8. The method of claim **1**, wherein causing the one or more first cloud servers to add multimedia content to the local playback queue comprises causing an identifier of the multimedia content to be added to the local playback queue, wherein the identifier indicates a particular source of the multimedia content at the one or more second cloud servers of the streaming content service, wherein the particular playback device receives the multimedia content from the particular source at the one or more second cloud servers of the streaming content service.

9. The method of claim **1**, wherein causing one or more first cloud servers to add the multimedia content to the local playback queue on the particular playback device comprises sending a message to the streaming content service that causes the one or more first cloud servers to add the multimedia content to the local playback queue on the particular playback device.

10. The method of claim **1**, wherein detecting the set of inputs comprises detecting a selection of the multimedia content.

11. The method of claim **1**, wherein detecting the set of inputs comprises detecting an input that causes playback at the control device to be stopped.

12. The method of claim **1**, wherein detecting the set of inputs comprises detecting selection of a button on the control interface.

13. A tangible, non-transitory computer readable storage medium including instructions for execution by a processor, the instructions, when executed, cause a control device to implement a method comprising:

causing a graphical interface to display a control interface including one or more transport controls to control playback by the control device;

after connecting to a local area network via a network interface, identifying playback devices connected to the local area network;

causing the graphical interface to display a selectable option for transferring playback from the control device;

detecting a set of inputs to transfer playback from the control device to a particular playback device, wherein the set of inputs comprises: (i) a selection of the selectable option for transferring playback from the control device and (ii) a selection of the particular playback device from the identified playback devices connected to the local area network:

after detecting the set of inputs to transfer playback from the control device to the particular playback device, causing playback to be transferred from the control device to the particular playback device, wherein transferring playback from the control device to the particular playback device comprises:

(a) causing one or more first cloud servers to add multimedia content to a local playback queue on the particular playback device, wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service;

(b) causing playback at the control device to be stopped; and

(c) modifying the one or more transport controls of the control interface to control playback by the playback device; and

causing the particular playback device to play back the multimedia content, wherein the particular playback device playing back the multimedia content comprises the particular playback device retrieving the multimedia content from one or more second cloud servers of a streaming content service and playing back the retrieved multimedia content.

14. The tangible, non-transitory computer readable medium of claim **13**, wherein detecting the set of inputs to transfer playback from the control device to the particular playback device comprises detecting a set of inputs to transfer playback from the control device to a particular zone of a media playback system that includes the particular playback device as a first channel of a stereo pair and an additional playback device as a second channel of the stereo pair, wherein modifying the one or more transport controls of the control interface to control playback by the particular playback device comprises causing the one or more transport controls of the control interface to control playback by the particular playback device and the additional playback device, and wherein the particular playback device playing back the retrieved multimedia content comprises the particular playback device and the additional playback device playing back the multimedia content as the stereo pair.

15. The tangible, non-transitory computer readable medium of claim **13**, wherein detecting the set of inputs to transfer playback from the control device to the particular playback device comprises detecting a set of inputs to transfer playback from the control device to a particular zone group of a media particular playback system that includes a first zone and a second zone, wherein the first zone includes the particular playback device and the second zone includes at least one additional playback device, wherein modifying the one or more transport controls of the control interface to control playback by the playback device comprises causing the one or more transport controls of the control interface to control playback by the particular playback device and the at least one additional playback device in synchrony, and wherein the particular playback device playing back the retrieved multimedia content comprises the particular playback device and the at least one additional playback device playing back the multimedia content in synchrony.

16. The tangible, non-transitory computer readable medium of claim **13**, wherein the control interface is displayed by an application associated with the streaming content service, and wherein the set of inputs further com-

prises detecting an input to select a link in the application associated with the streaming content service and wherein selection of the link launches a second application to facilitate retrieving the multimedia content by the particular playback device from a particular source indicated by a resource locator.

17. The tangible, non-transitory computer readable medium of claim **13**, wherein the control interface is displayed by an application associated with the streaming content service, and wherein the set of inputs further comprises detecting an input to select a link in the application associated with the streaming content service and wherein selection of the link causes the control device to transmit information to the one or more first cloud servers to add multimedia content to the local playback queue on the particular playback device.

18. The tangible, non-transitory computer readable medium of claim **13**, wherein the method further comprises detecting a set of inputs to transfer playback from the playback device back to the control device, wherein transferring playback from the playback device back to the control device comprises:

causing playback at the playback device to be stopped; and

modifying the one or more transport controls of the control interface to control playback by the control device.

19. The tangible, non-transitory computer readable medium of claim **13**, wherein causing the graphical interface to display the control interface including one or more transport controls to control playback by the control device comprises causing the graphical interface to display a control interface that includes the one or more transport controls in a particular arrangement on the graphical interface, and wherein modifying the one or more transport controls of the control interface to control playback by the playback device comprises causing the graphical interface to display the one or more transport controls to control playback by the playback device in the particular arrangement.

20. The tangible, non-transitory computer readable medium of claim **13**, wherein causing the one or more first cloud servers to add multimedia content to the local playback queue on the particular playback device comprises causing an identifier of the multimedia content to be added to the local playback queue, wherein the identifier indicates a particular source of the multimedia content at the one or more second cloud servers of the streaming content service, wherein the particular playback device receives the multimedia content from the particular source at the one or more second cloud servers of the streaming content service.

21. The tangible, non-transitory computer readable medium of claim **13**, wherein causing one or more first cloud servers to add the multimedia content to the local playback queue on the particular playback device comprises sending a message to the streaming content service that causes the one or more first cloud servers to add the multimedia content to the local playback queue on the particular playback device.

22. The tangible, non-transitory computer readable medium of claim **13**, wherein detecting the set of inputs comprises detecting a selection of the multimedia content.

23. The tangible, non-transitory computer readable medium of claim **13**, wherein detecting the set of inputs comprises detecting an input that causes playback at the control device to be stopped.

24. The tangible, non-transitory computer readable medium of claim **13**, wherein detecting the set of inputs comprises detecting selection of a button on the control interface.

25. A control device comprising:

a graphical interface;

a wireless communication interface to communicate with a playback device;

one or more processors;

tangible non-transitory computer-readable media having instructions encoded therein, wherein the instructions, when executed by the one or more processors, cause the control device to perform functions comprising:

causing the graphical interface to display a control interface including one or more transport controls to control playback by the control device;

after connecting to a local area network via the wireless communication interface, identifying playback devices connected to the local area network;

causing the graphical interface to display a selectable option for transferring playback from the control device;

detecting a set of inputs to transfer playback from the control device to a particular playback device, wherein the set of inputs comprises: (i) a selection of the selectable option for transferring playback from the control device and (ii) a selection of the particular playback device from the identified playback devices connected to the local area network:

after detecting the set of inputs to transfer playback from the control device to the particular playback device, causing playback to be transferred from the control device to the particular playback device, wherein transferring playback from the control device to the particular playback device comprises:

(a) causing one or more first cloud servers to add multimedia content to a local playback queue on the particular playback device, wherein adding the multimedia content to the local playback queue comprises the one or more first cloud servers adding, to the local playback queue, one or more resource locators corresponding to respective locations of the multimedia content at one or more second cloud servers of a streaming content service;

(b) causing playback at the control device to be stopped; and

(c) modifying the one or more transport controls of the control interface to control playback by the playback device; and

causing the particular playback device to play back the multimedia content, wherein the particular playback device playing back the multimedia content comprises the particular playback device retrieving the multimedia content from one or more second cloud servers of a streaming content service and playing back the retrieved multimedia content.

26. The control device of claim **25**, wherein detecting the set of inputs to transfer playback from the control device to the particular playback device comprises detecting a set of inputs to transfer playback from the control device to a particular zone group of a media particular playback system that includes a first zone and a second zone, wherein the first zone includes the particular playback device and the second zone includes at least one additional playback device, wherein modifying the one or more transport controls of the

control interface to control playback by the playback device comprises causing the one or more transport controls of the control interface to control playback by the particular playback device and the at least one additional playback device in synchrony, and wherein the particular playback device playing back the retrieved multimedia content comprises the particular playback device and the at least one additional playback device playing back the multimedia content in synchrony.

27. The control device of claim **25**, wherein detecting the set of inputs comprises detecting a selection of the multimedia content.

28. The control device of claim **25**, wherein detecting the set of inputs comprises detecting an input that causes playback at the control device to be stopped.

29. The control device of claim **25**, wherein detecting the set of inputs comprises detecting selection of a button on the control interface.

* * * * *

EXHIBIT 2

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(54) **SYSTEMS AND METHODS FOR NETWORKED MUSIC PLAYBACK**

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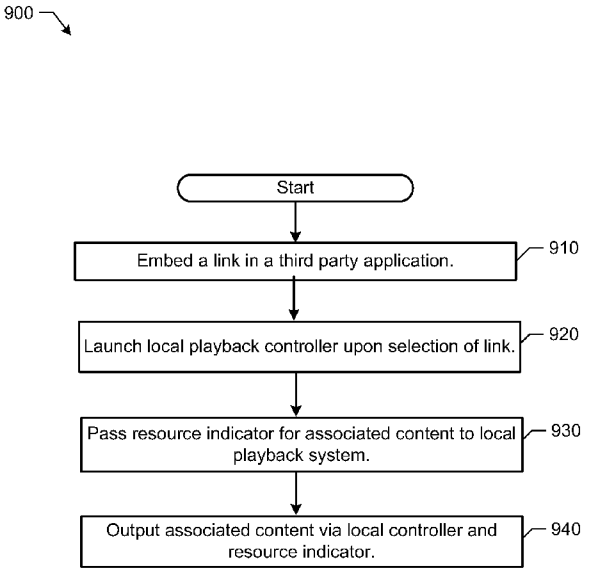
(57) **ABSTRACT**

An example computing device in a first mode is configured for playback of given audio content. While in the first mode, the computing device displays a representation of one or more playback devices in a media playback system that are available to accept playback responsibility for the given audio content and receives user input indicating a selection of a given playback device. The computing device transmits an instruction for playback responsibility to be transferred to the given playback device such that i) an identifier of the given audio content and a playback position for the given audio content are provided to the given playback device and ii) the given playback device becomes configured for playback of the given audio content. The computing device transitions from the first mode to a second mode in which the computing device is configured to control the given playback device's playback of the given audio content.

16 Claims, 11 Drawing Sheets



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USPC 700/94; 715/716, 727, 765, 771

See application file for complete search history.

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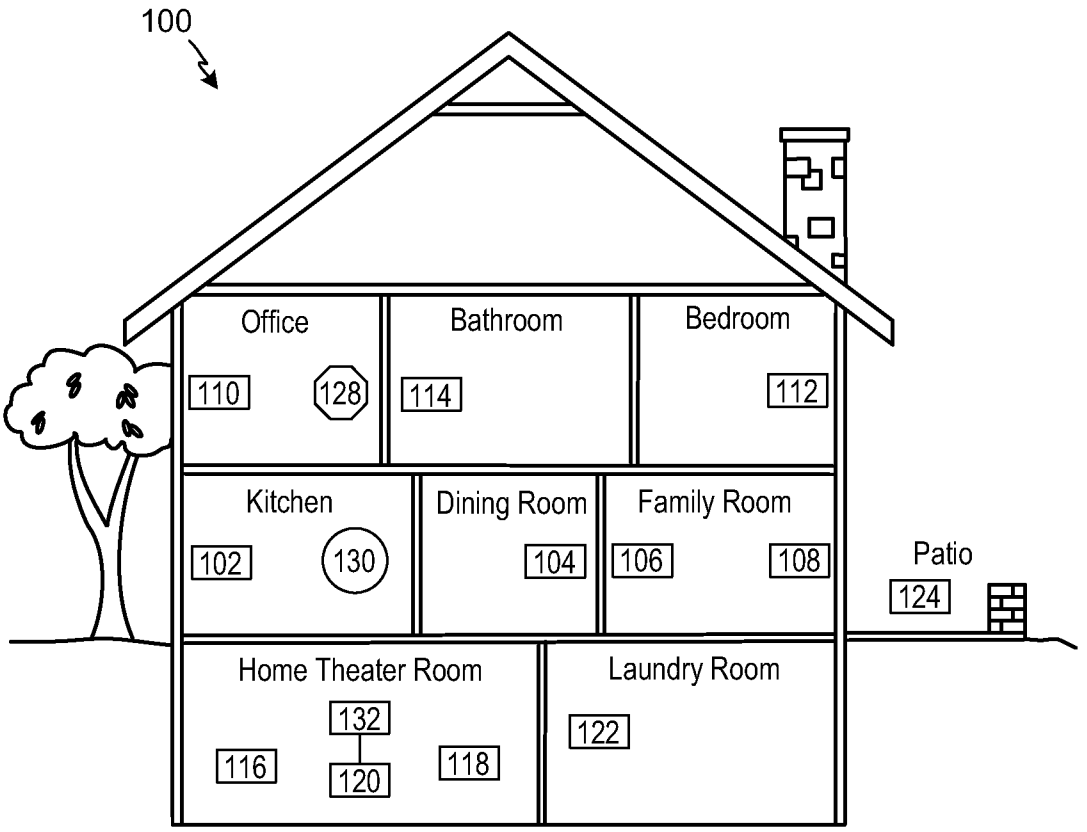
100
Office
110
128
Bathroom
114
Bedroom
112
Kitchen
102
130
Dining Room
104
Family Room
106
108
Patio
124
Home Theater Room
132
116
120
118
Laundry Room
122

FIGURE 1

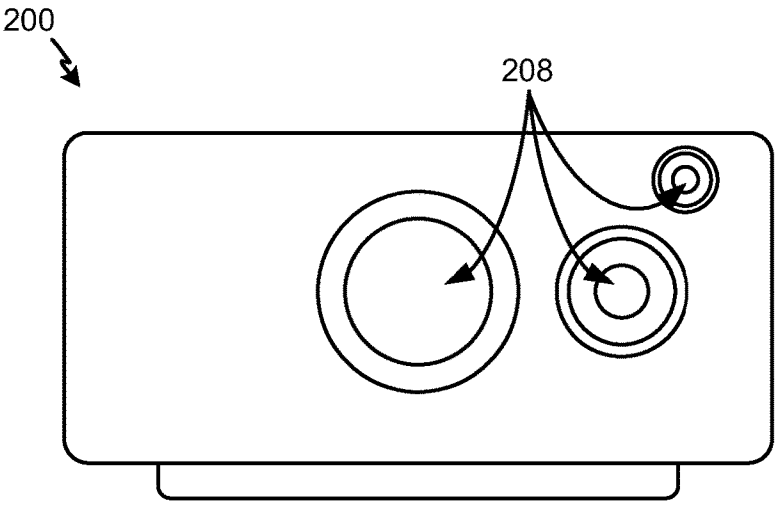

FIGURE 2A

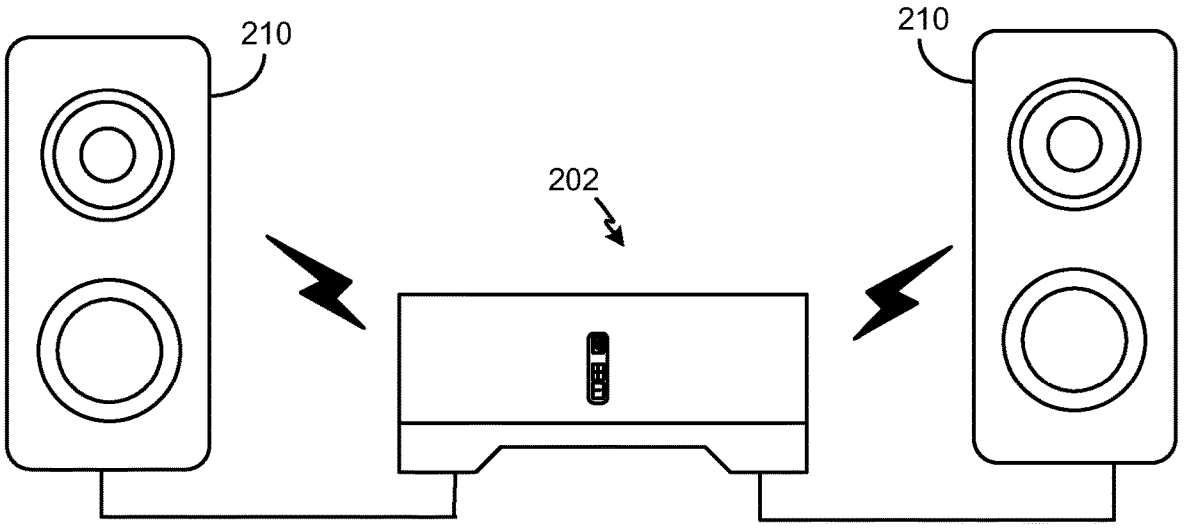

FIGURE 2B

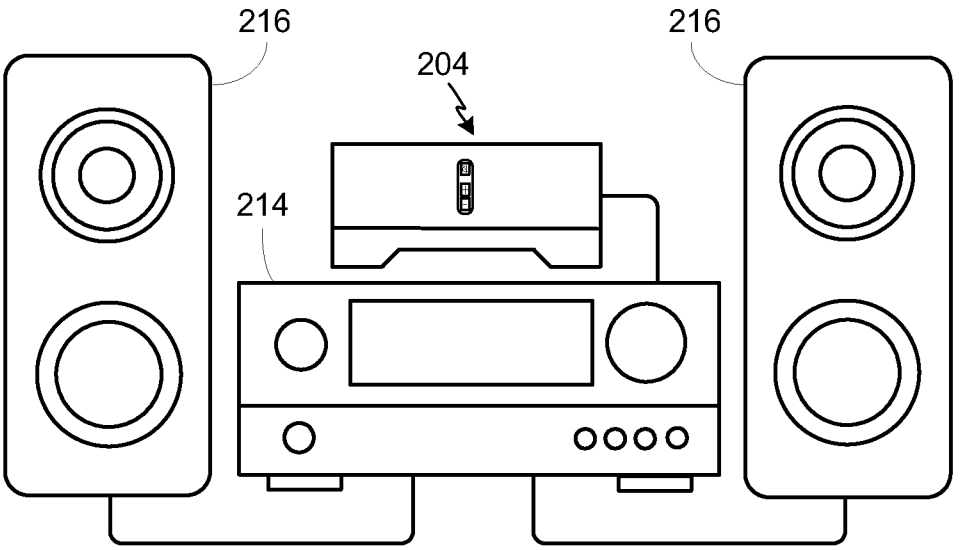

FIGURE 2C

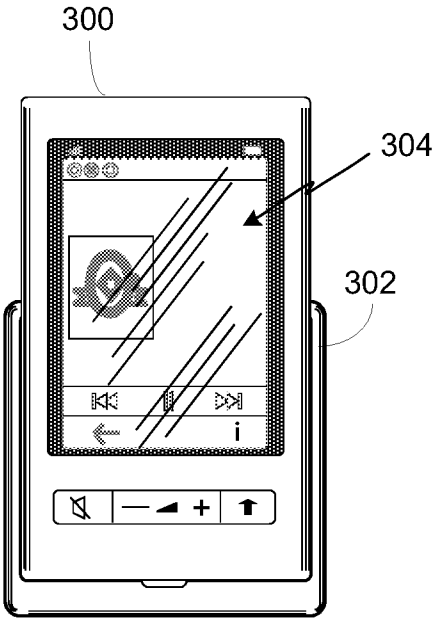

FIGURE 3

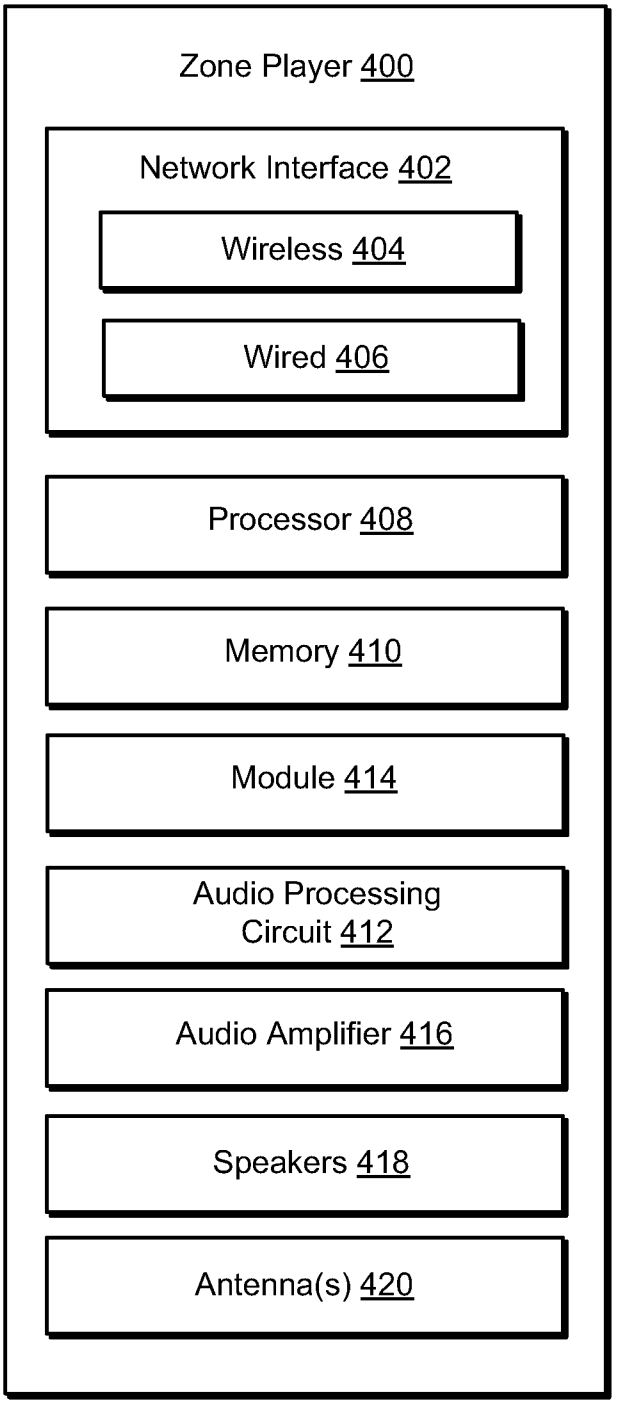
Zone Player 400
Network Interface 402
Wireless 404
Wired 406
Processor 408
Memory 410
Module 414
Audio Processing Circuit 412
Audio Amplifier 416
Speakers 418
Antenna(s) 420

FIGURE 4

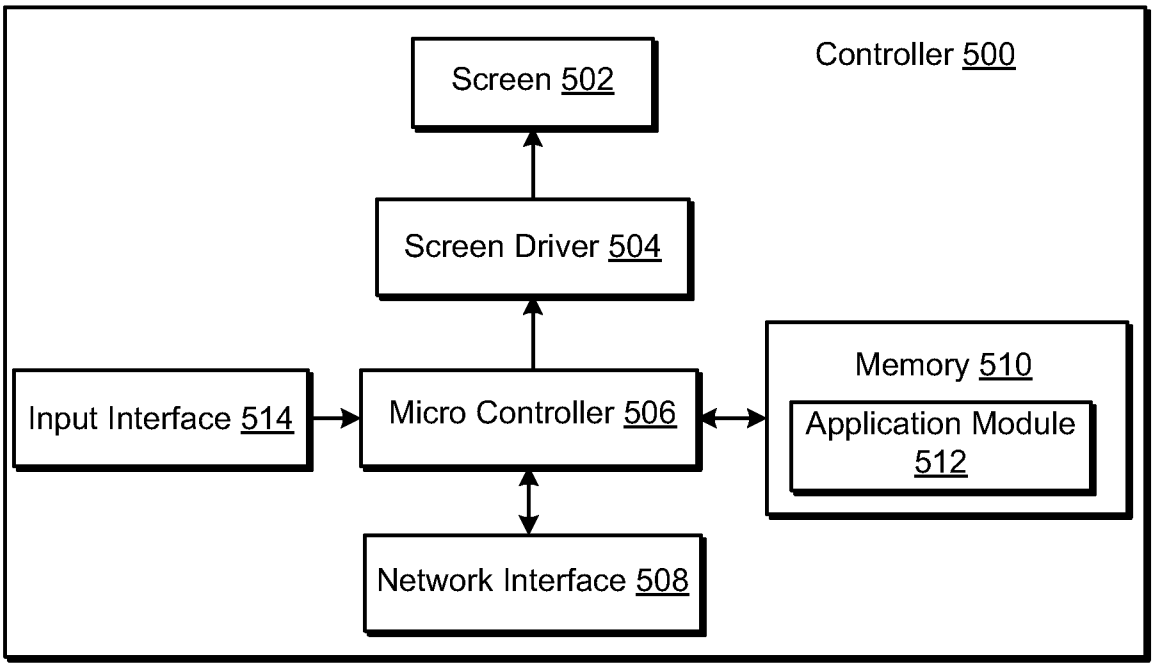
Controller 500
Screen 502
Screen Driver 504
Input Interface 514
Micro Controller 506
Memory 510
Application Module 512
Network Interface 508

FIGURE 5

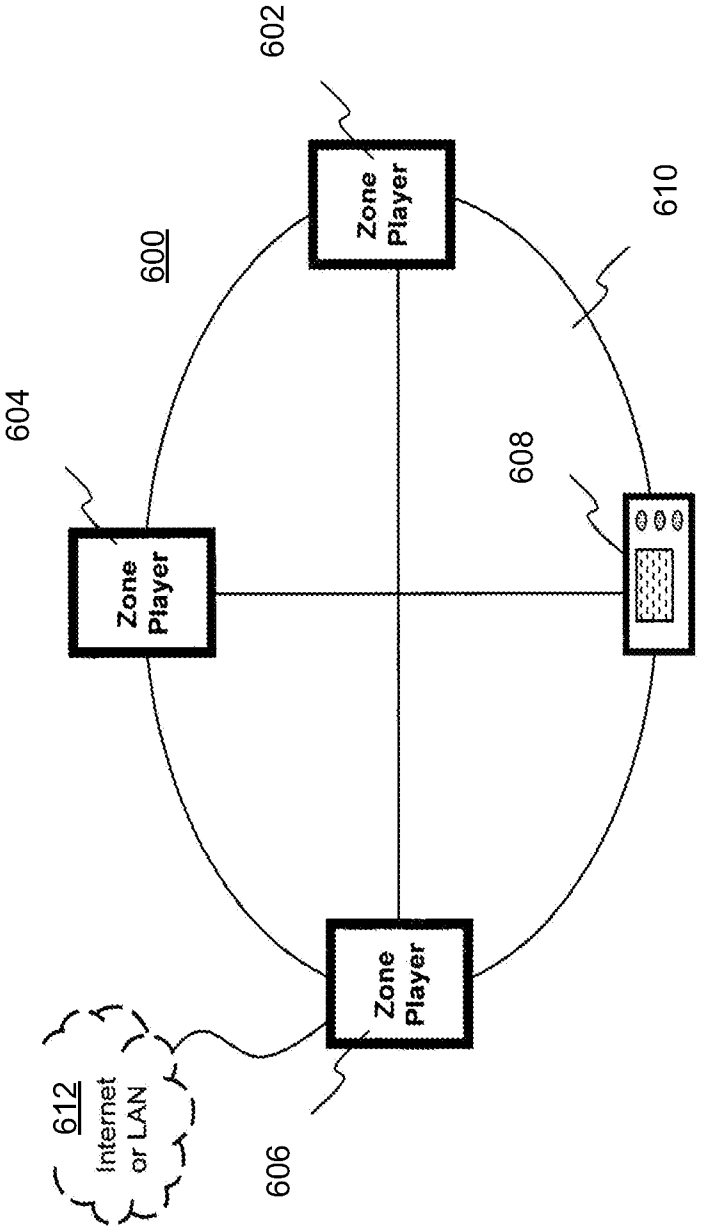
602
600
610
604
608
Zone Player
Zone Player
Zone Player
612
Internet or LAN
606

FIGURE 6

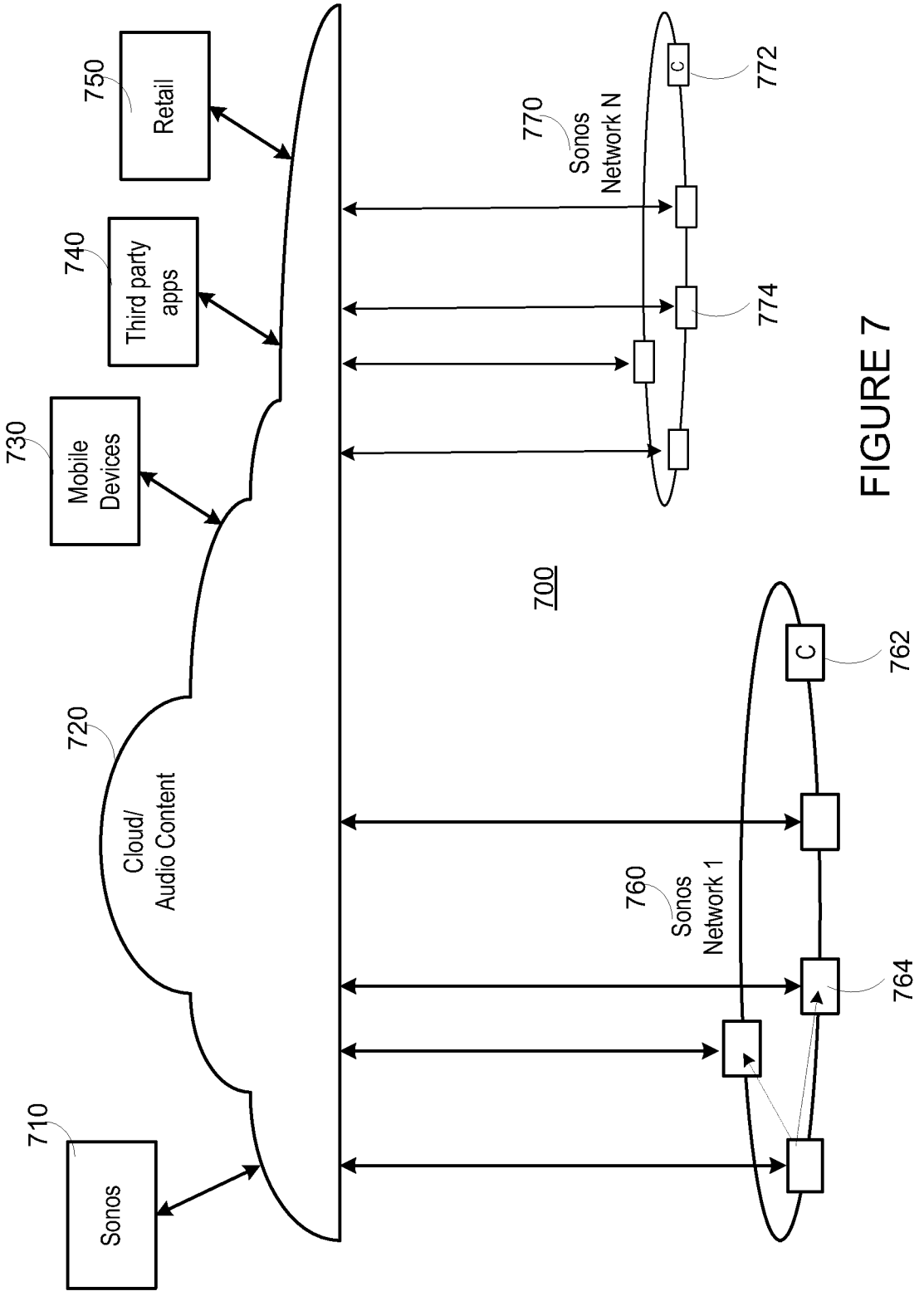
750
Retail
740
Third party apps
730
Mobile Devices
720
Cloud/ Audio Content
710
Sonos
700
770
Sonos Network N
772
C
774
760
Sonos Network 1
762
C
764

FIGURE 7

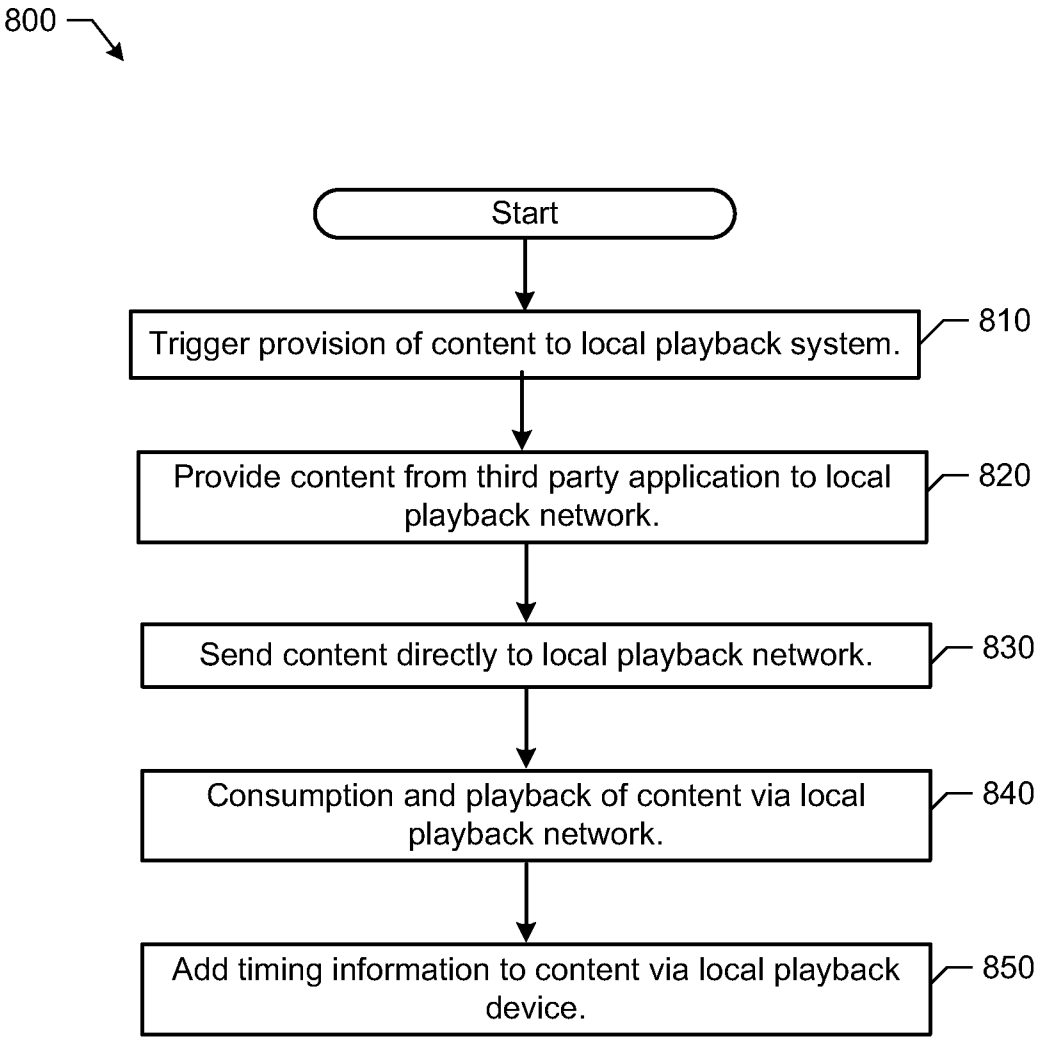
800
Start
Trigger provision of content to local playback system.
810
Provide content from third party application to local playback network.
820
Send content directly to local playback network.
830
Consumption and playback of content via local playback network.
840
Add timing information to content via local playback device.
850

FIGURE 8

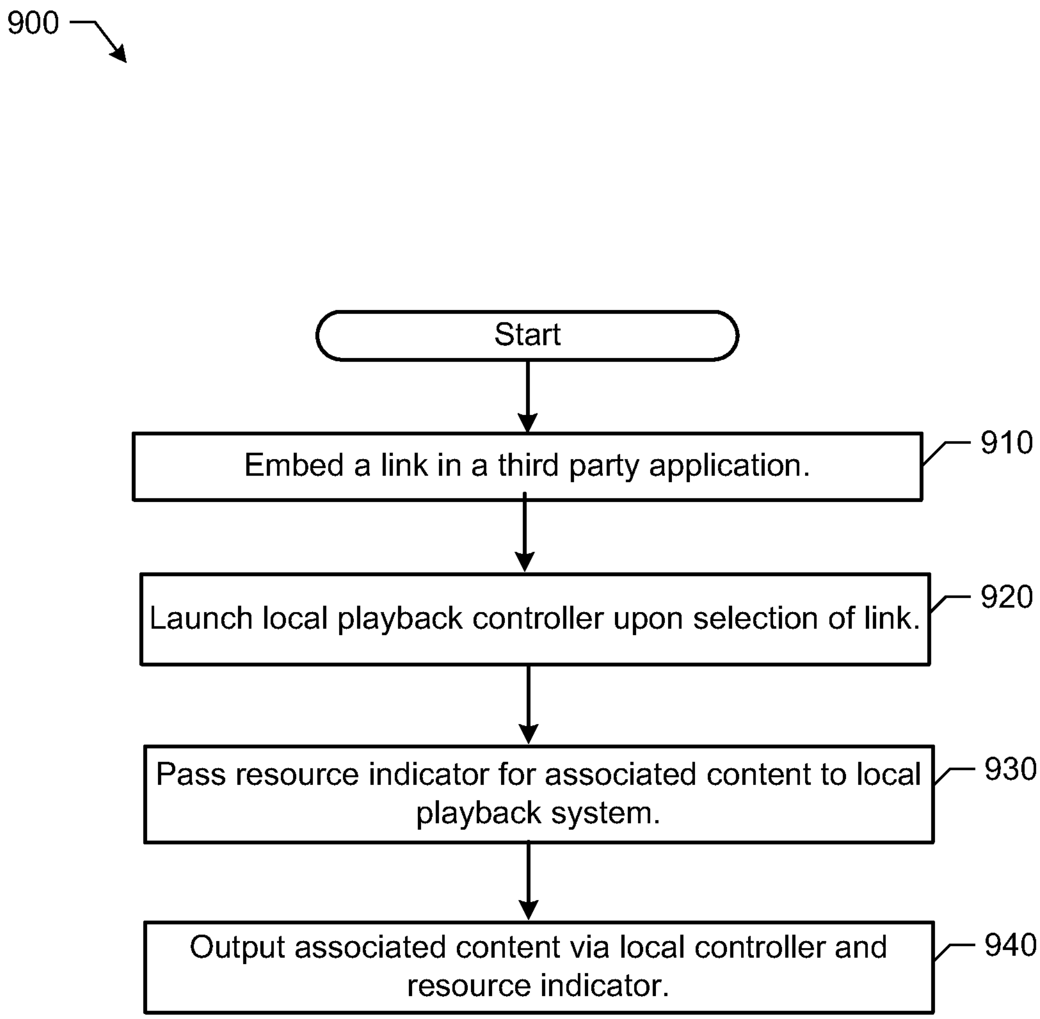
900
Start
Embed a link in a third party application.
910
Launch local playback controller upon selection of link.
920
Pass resource indicator for associated content to local playback system.
930
Output associated content via local controller and resource indicator.
940

FIGURE 9

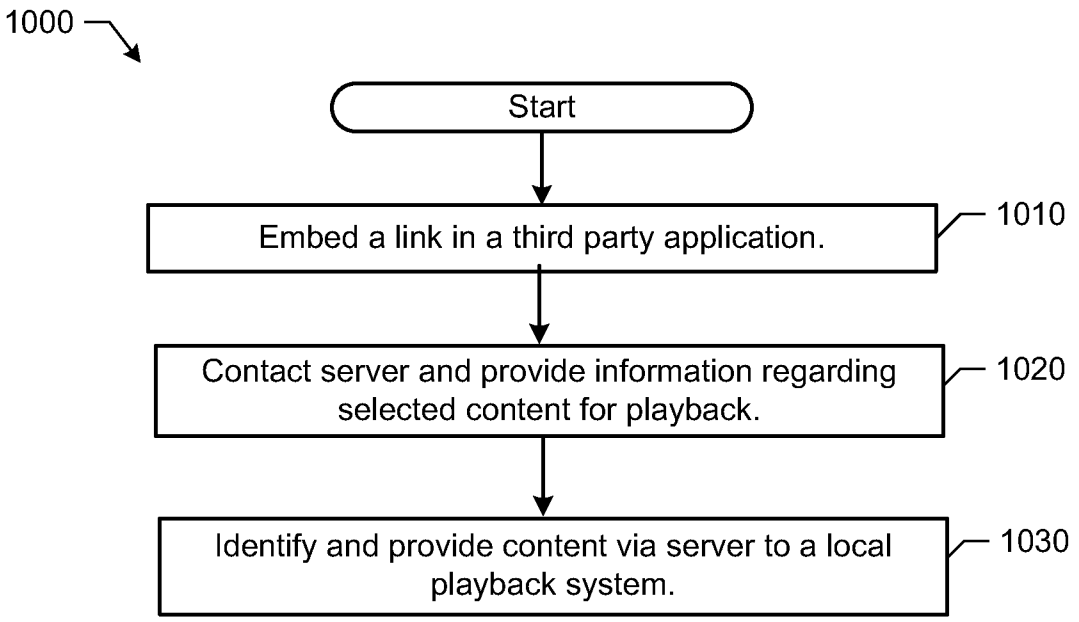
1000
Start
Embed a link in a third party application.
1010
Contact server and provide information regarding selected content for playback.
1020
Identify and provide content via server to a local playback system.
1030

FIGURE 10

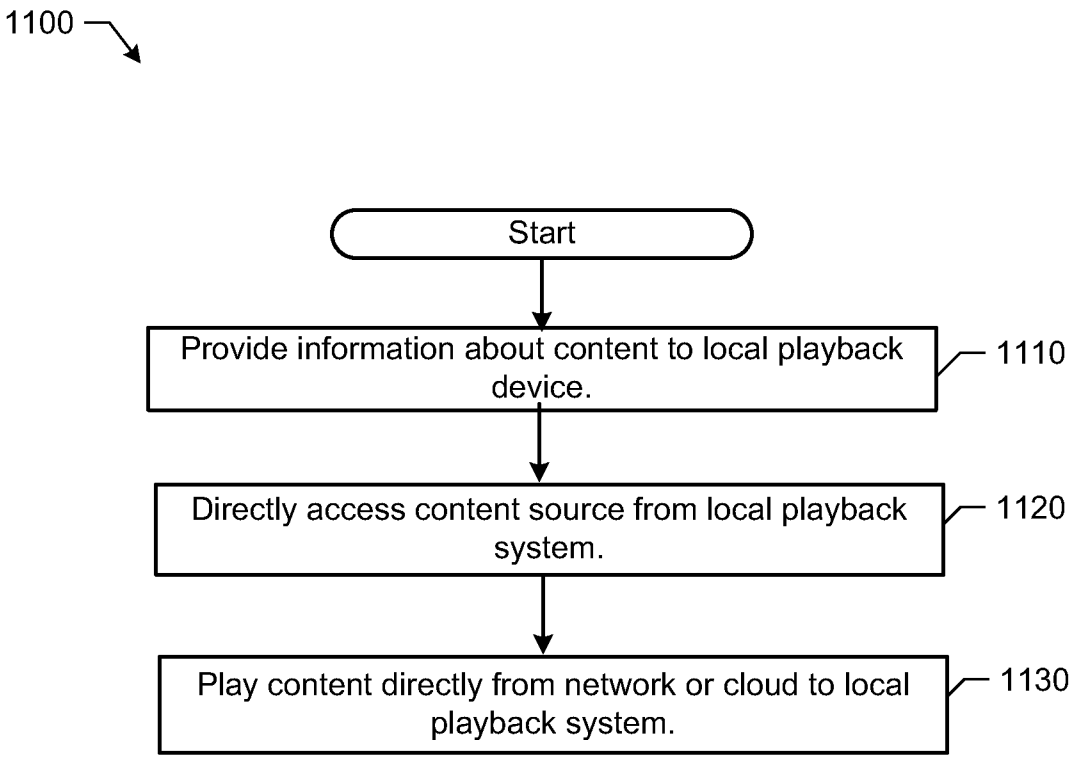
1100
Start
Provide information about content to local playback device.
1110
Directly access content source from local playback system.
1120
Play content directly from network or cloud to local playback system.
1130

FIGURE 11

SYSTEMS AND METHODS FOR NETWORKED MUSIC PLAYBACK

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. non-provisional patent application Ser. No. 15/872,500, filed on Jan. 16, 2018, entitled "Systems and Methods for Networked Music Playback," which is a continuation of U.S. non-provisional patent application Ser. No. 14/520,578, filed on Oct. 22, 2014, entitled "Systems and Methods for Networked Music Playback," which is a continuation of U.S. non-provisional patent application Ser. No. 13/341,237, filed on Dec. 30, 2011, entitled "Systems and Methods for Networked Music Playback," all of which are incorporated herein by reference in their entirety.

FIELD OF THE DISCLOSURE

The disclosure is related to consumer electronics and, more particularly, to providing music for playback via one or more devices on a playback data network.

BACKGROUND

Technological advancements have increased the accessibility of music content, as well as other types of media, such as television content, movies, and interactive content. For example, a user can access audio, video, or both audio and video content over the Internet through an online store, an Internet radio station, an online music service, an online movie service, and the like, in addition to the more traditional avenues of accessing audio and video content. Demand for such audio and video content continues to surge. Given the high demand, technology used to access and play such content has likewise improved.

BRIEF DESCRIPTION OF THE DRAWINGS

Features, aspects, and advantages of the presently disclosed technology are better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. **1** shows an illustration of an example system in which embodiments of the methods and apparatus disclosed herein can be implemented;

FIG. **2**A shows an illustration of an example zone player having a built-in amplifier and speakers;

FIG. **2**B shows an illustration of an example zone player having a built-in amplifier and connected to external speakers;

FIG. **2**C shows an illustration of an example zone player connected to an A/V receiver and speakers;

FIG. **3** shows an illustration of an example controller;

FIG. **4** shows an internal functional block diagram of an example zone player;

FIG. **5** shows an internal functional block diagram of an example controller;

FIG. **6** shows an example ad-hoc playback network;

FIG. **7** shows a system including a plurality of networks including a cloud-based network and at least one local playback network; and

FIGS. **8-11** show flow diagrams for methods to provide audio content to a local playback system.

In addition, the drawings are for the purpose of illustrating example embodiments, but it is understood that the present disclosure is not limited to the arrangements and instrumentality shown in the drawings.

DETAILED DESCRIPTION

I. Overview

Wired or wireless networks can be used to connect one or more multimedia playback devices for a home or other location playback network (e.g., a home music system). Certain examples provide automatic configuration of parameters of a playback device to be coupled to a network with reduced or minimum human intervention. For example, a wired and/or wireless ad-hoc network is established to facilitate communications among a group of devices. Music and/or other multimedia content can be shared among devices and/or groups of devices (also referred to herein as zones) associated with a playback network.

Certain embodiments facilitate streaming or otherwise providing music from a music-playing application (e.g., browser-based application, native music player, other multimedia application, and so on) to a multimedia content playback (e.g., Sonos™) system. Certain embodiments provide simple, easy-to-use and secure systems and methods for multimedia content playback across a plurality of systems and locations. Certain embodiments facilitate integration between content partners and a playback system as well as supporting maintenance of such content and system.

Although the following discloses example systems, methods, apparatus, and articles of manufacture including, among other components, firmware and/or software executed on hardware, it should be noted that such systems, methods, apparatus, and/or articles of manufacture are merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all of these firmware, hardware, and/or software components could be embodied exclusively in hardware, exclusively in software, exclusively in firmware, or in any combination of hardware, software, and/or firmware. Accordingly, while the following describes example systems, methods, apparatus, and/or articles of manufacture, the examples provided are not the only way(s) to implement such systems, methods, apparatus, and/or articles of manufacture.

When any of the appended claims are read to cover a purely software and/or firmware implementation, at least one of the elements in at least one example is hereby expressly defined to include a tangible medium such as a memory, DVD, CD, Blu-ray, and so on, storing the software and/or firmware.

Reference herein to "embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one example embodiment of the invention. The appearances of this phrase in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. As such, the embodiments described herein, explicitly and implicitly understood by one skilled in the art, can be combined with other embodiments.

Certain embodiments provide a method to provide content to a local playback network. The example method includes identifying multimedia content from a content provider. The example method includes passing information regarding the multimedia content to a local playback system including one or more multimedia playback devices in response to a trigger. The example method includes facilitating play of the

multimedia content via a local playback network associated with the local playback system.

Certain embodiments provide a computer readable storage medium including instructions for execution by a processor, the instructions, when executed, cause the processor to implement a method to provide content to a local playback network. The example method includes identifying multimedia content from a content provider. The example method includes passing information regarding the multimedia content to a local playback system including one or more multimedia playback devices in response to a trigger. The example method includes facilitating play of the multimedia content via a local playback network associated with the local playback system.

Certain embodiments provide a multimedia playback device including a wireless communication interface to communicate with a local playback network and a multimedia content source and a processor. The process is to identify multimedia content from the multimedia content source; pass information regarding the multimedia content to device on the local playback network in response to a trigger; and facilitate play of the multimedia content via the devices on the local playback network.

II. Example Environment

Referring now to the drawings, in which like numerals can refer to like parts throughout the figures, FIG. **1** shows an example system configuration **100** in which one or more of the method and/or apparatus disclosed herein can be practiced or implemented. By way of illustration, the system configuration **100** represents a home with multiple zones. Each zone, for example, represents a different room or space, such as an office, bathroom, bedroom, kitchen, dining room, family room, home theater room, utility or laundry room, and patio. While not shown here, a single zone can cover more than one room or space. One or more of zone players **102-124** are shown in each respective zone. A zone player **102-124**, also referred to as a playback device, multimedia unit, speaker, and so on, provides audio, video, and/or audiovisual output. A controller **130** (e.g., shown in the kitchen for purposes of illustration) provides control to the system configuration **100**. The system configuration **100** illustrates an example whole house audio system, though it is understood that the technology described herein is not limited to its particular place of application or to an expansive system like a whole house audio system **100** of FIG. **1**.

FIGS. **2**A, **2**B, and **2**C show example illustrations of zone players **200-204**. The zone players **200-204** of FIGS. **2**A, **2**B, and **2**C, respectively, can correspond to any of the zone players **102-124** of FIG. **1**. While certain embodiments provide multiple zone players, an audio output can be generated using only a single zone player. FIG. **2**A illustrates a zone player **200** including sound producing equipment **208** capable of generating sound or an audio output corresponding to a signal received (e.g., wirelessly and/or via a wired interface). The sound producing equipment **208** of the zone player **200** of FIG. **2**A includes a built-in amplifier (not shown in this illustration) and speakers (e.g., a tweeter, a mid-range driver, and/or a subwoofer). In certain embodiments, the zone player **200** of FIG. **2**A can be configured to play stereophonic audio or monaural audio. In some embodiments, the zone player **200** of FIG. **2**A can be configured as a component in a combination of zone players to play stereophonic audio, monaural audio, and/or surround audio. As described in greater detail below, in some embodiments, the example zone player **200** of FIG. **2**A can also transmit a second signal to, for example, other zone player(s) in the same or different zone(s), speaker(s), receiver(s), and so on. Transmission of the second signal can be part of, for example, a system in which multiple zone players, speakers, receivers, and so on, form a network to, for example, present media content in a synchronization or distributed manner.

The example zone player **202** of FIG. **2**B includes a built-in amplifier (not shown in this illustration) to power a set of detached speakers **210**. The speakers **210** of FIG. **2**B can include, for example, any type of loudspeaker. The zone player **202** of FIG. **2**B can communicate a signal corresponding to audio content to the detached speakers **210** via wired and/or wireless channels. Instead of receiving and generating audio content as in FIG. **2**A, the zone player **202** of FIG. **2**B receives the audio content and transmits the same (e.g., after processing the received signal) to the detached speakers **210**. Similar to the example zone player **200** of FIG. **2**A, in some embodiments the zone player **202** can transmit a second signal to, for example, other zone player(s) in the same or different zone(s), speaker(s), receiver(s), and so on.

The example zone player **204** of FIG. **2**C does not include an amplifier, but allows a receiver **214**, or another audio and/or video type device with built-in amplification, to connect to a data network **128** of FIG. **1** and to play audio received over the data network **128** viathe receiver **214** and a set of detached speakers **216**. In addition to the wired couplings shown in FIG. **2**C, the detached speakers **216** can receive audio content via a wireless communication channel between the detached speakers **216** and, for example, the zone player **204** and/or the receiver **214**. In some embodiments the zone player **202** can transmit a second signal to, for example, other zone player(s) in the same or different zone(s), speaker(s), receiver(s), and so on.

Example zone players include a "Sonos® S5," "Sonos Play:5," "Sonos Play:3," "ZonePlayer 120," and "ZonePlayer 90," which are offered by Sonos, Inc. of Santa Barbara, Calif. Any other past, present, and/or future zone players can additionally or alternatively be used to implement the zone players of example embodiments disclosed herein. A zone player can also be referred to herein as a playback device, and a zone player is not limited to the particular examples illustrated in FIGS. **2**A, **2**B, and **2**C. For example, a zone player can include a wired or wireless headphone. In other examples, a zone player might include a subwoofer. In yet other examples, a zone player can include a sound bar. In an example, a zone player can include or interact with a docking station for an Apple iPod™ or similar device. In some embodiments, a zone player can relay one or more signals received from, for example, a first zone player to another playback device. In some embodiments, a zone player can receive a first signal and generate an output corresponding to the first signal and, simultaneously or separately, can receive a second signal and transmit or relay the second signal to another zone player(s), speaker(s), receiver(s), and so on. Thus, an example zone player described herein can act as a playback device and, at the same time, operate as a hub in a network of zone players. In such instances, media content corresponding to the first signal can be different from the media content corresponding to the second signal.

FIG. **3** shows an example illustration of a wireless controller **300** in a docking station **302**. The controller **300** can correspond to the controlling device **130** of FIG. **1**. The controller **300** is provided with a touch screen **304** that allows a user to interact with the controller **300**, for example, to retrieve and navigate a playlist of audio items, control operations of one or more zone players, and provide overall

control of the system configuration **100**. In certain embodiments, any number of controllers can be used to control the system configuration **100**. In certain embodiments, there can be a limit on the number of controllers that can control the system configuration **100**. The controllers might be wireless like wireless controller **300** or wired to the data network **128**. Furthermore, an application running on any network-enabled portable devices, such as an iPhone™, iPad™, Android™ powered phone, or any other smart phone or network-enabled device can be used as a controller by connecting to the data network **128**. An application running on a laptop or desktop PC or Mac can also be used as a controller. Example controllers include a "Sonos® Controller **200**," "Sonos® Controller for iPhone," "Sonos® Controller for iPad," "Sonos® Controller for Android, "Sonos® Controller for Mac or PC," which are offered by Sonos, Inc. of Santa Barbara, Calif. The flexibility of such an application and its ability to be ported to a new type of portable device is advantageous.

Referring back to the system configuration **100** of FIG. **1**, a particular zone can contain one or more zone players. For example, the family room of FIG. **1** contains two zone players **106** and **108**, while the kitchen is shown with one zone player **102**. Zones can be dynamically configured by positioning a zone player in a room or space and assigning via the controller **130** the zone player to a new or existing zone. As such, zones can be created, combined with another zone, removed, and given a specific name (e.g., "Kitchen"), if so programmed. The zone players **102** to **124** are coupled directly or indirectly to a data network, such as the data network **128** shown in FIG. **1**. The data network **128** is represented by an octagon in the figure to stand out from other components shown in the figure. While the data network **128** is shown in a single location, it is understood that such a network can be distributed in and around the system configuration **100**.

Particularly, the data network **128** can be a wired network, a wireless network, or a combination of both. In some embodiments, one or more of the zone players **102-124** are wirelessly coupled to the data network **128** based on a proprietary mesh network. In some embodiments, one or more of the zone players **102-124** are wirelessly coupled to the data network **128** using a non-mesh topology. In some embodiments, one or more of the zone players **102-124** are coupled via a wire to the data network **128** using Ethernet or similar technology. In addition to the one or more zone players **102-124** connecting to the data network **128**, the data network **128** can further allow access to a wide area network, such as the Internet.

In certain embodiments, the data network **128** can be created by connecting any of the zone players **102-124**, or some other connecting device, to a broadband router. Other zone players **102-124** can then be added wired or wirelessly to the data network **128**. For example, a zone player (e.g., any of zone players **102-124**) can be added to the system configuration **100** by simply pressing a button on the zone player itself, which enables a connection to be made to the data network **128**. The broadband router can be connected to an Internet Service Provider (ISP), for example. The broadband router can be used to form another data network within the system configuration **100**, which can be used in other applications (e.g., web surfing). The data network **128** can also be used in other applications, if so programmed. Further, in certain embodiments, the data network **128** is the same network used for other applications in the household.

In certain embodiments, each zone can play from the same audio source as another zone or each zone can play from a different audio source. For example, someone can be grilling on the patio and listening to jazz music via zone player **124**, while someone is preparing food in the kitchen and listening to classical music via zone player **102**. Further, someone can be in the office listening to the same jazz music via zone player **110** that is playing on the patio via zone player **124**. In some embodiments, the jazz music played via zone players **110** and **124** is played in synchrony. Synchronizing playback amongst zones allows for someone to pass through zones while seamlessly listening to the audio. Further, zones can be put into a "party mode" such that all associated zones will play audio in synchrony.

In certain embodiments, a zone contains two or more zone players. For example, the family room contains two zone players **106** and **108**, and the home theater room contains at least zone players **116**, **118**, and **120**. A zone can be configured to contain as many zone players as desired, and for example, the home theater room might contain additional zone players to play audio from a 5.1 channel or greater audio source (e.g., a movie encoded with 5.1 or greater audio channels). If a zone contains two or more zone players, such as the two zone players **106** and **108** in the family room, then the two zone players **106** and **108** can be configured to play the same audio source in synchrony, or the two zone players **106** and **108** can be paired to play two separate sounds in left and right channels, for example. In other words, the stereo effects of a sound can be reproduced or enhanced through the two zone players **106** and **108**, one for the left sound and the other for the right sound. In certain embodiments, paired zone players can play audio in synchrony with other zone players.

In certain embodiments, three or more zone players can be configured to play various channels of audio that is encoded with three channels or more sound. For example, the home theater room shows zone players **116**, **118**, and **120**. If the sound is encoded as 2.1 channel audio, then the zone player **116** can be configured to play left channel audio, the zone player **118** can be configured to play right channel audio, and the zone player **120** can be configured to play bass frequencies. Other configurations are possible and depend on the number of zone players and the type of audio. Further, a particular zone can be configured to play a 5.1 channel audio in one instance, such as when playing audio from a movie, and then dynamically switch to play stereo, such as when playing audio from a two channel source.

In certain embodiments, two or more zone players can be sonically consolidated to form a single, consolidated zone player. A consolidated zone player (though made up of multiple, separate devices) can be configured to process and reproduce sound differently than an unconsolidated zone player or zone players that are paired, because a consolidated zone player will have additional speaker drivers from which sound can be passed. The consolidated zone player can further be paired with a single zone player or yet another consolidated zone player. Each playback device of a consolidated playback device is preferably set in a consolidated mode.

According to some embodiments, one can continue to do any of: group, consolidate, and pair zone players, for example, until a desired configuration is complete. The actions of grouping, consolidation, and pairing are preferably performed through a control interface, such as using controller **130**, and not by physically connecting and reconnecting speaker wire, for example, to individual, discrete speakers to create different configurations. As such, certain

embodiments described herein provide a more flexible and dynamic platform through which sound reproduction can be offered to the end-user.

Sources of audio content to be played by zone players **102-124** are numerous. Music from a personal library stored on a computer or networked-attached storage (NAS) can be accessed via the data network **128** and played. Internet radio stations, shows, and podcasts can be accessed via the data network **128**. Music services that let a user stream and download music and audio content can be accessed via the data network **128**. Further, music can be obtained from traditional sources, such as a turntable or CD player, via a line-in connection to a zone player, for example. Audio content can also be accessed through AirPlay™ wireless technology by Apple, Inc., for example. Audio content received from one or more sources can be shared amongst the zone players **102** to **124** via the data network **128** and/or the controller **130**. The above-disclosed sources of audio content are referred to herein as network-based audio information sources. However, network-based audio information sources are not limited thereto.

The example home theater zone players **116**, **118**, **120** are coupled to an audio information source such as a television **132**. In some examples, the television **132** is used as a source of audio for the home theater zone players **116**, **118**, **120**, while in other examples audio information from the television **132** can be shared with any of the zone players **102-124** in the audio system **100**.

III. Example Playback Device

Referring now to FIG. **4**, there is shown an example functional block diagram of a zone player **400** in accordance with an embodiment. The zone player **400** of FIG. **4** includes a network interface **402**, a processor **408**, a memory **410**, an audio processing component **412**, a module **414**, an audio amplifier **416**, and a speaker unit **418** coupled to the audio amplifier **416**. FIG. **2**A shows an example illustration of such a zone player. Other types of zone players can not include the speaker unit **418** (e.g., such as shown in FIG. **2**B) or the audio amplifier **416** (e.g., such as shown in FIG. **2**C). Further, it is contemplated that the zone player **400** can be integrated into another component. For example, the zone player **400** could be constructed as part of a lamp for indoor or outdoor use.

Referring back to FIG. **4**, the network interface **402** facilitates a data flow between zone players and other devices on a data network (e.g., the data network **128** of FIG. **1**) and the zone player **400**. In some embodiments, the network interface **402** can manage the assembling of an audio source or file into smaller packets that are to be transmitted over the data network or reassembles received packets into the original source or file. In some embodiments, the network interface **402** can further handle the address part of each packet so that it gets to the right destination or intercepts packets destined for the zone player **400**. Accordingly, in certain embodiments, each of the packets includes an Internet Protocol (IP)-based source address as well as an IP-based destination address.

In some embodiments, the network interface **402** can include one or both of a wireless interface **404** and a wired interface **406**. The wireless interface **404**, also referred to as an RF interface, provides network interface functions for the zone player **400** to wirelessly communicate with other devices (e.g., other zone player(s), speaker(s), receiver(s), component(s) associated with the data network **128**, and so on) in accordance with a communication protocol (e.g., any of the wireless standards IEEE 802.11a, 802.11b, 802.11g, 802.11n, or 802.15). To receive wireless signals and to provide the wireless signals to the wireless interface **404** and to transmit wireless signals, the zone player **400** of FIG. **4** includes one or more antennas **420**. The wired interface **406** provides network interface functions for the zone player **400** to communicate over a wire with other devices in accordance with a communication protocol (e.g., IEEE 802.3). In some embodiments, a zone player includes both of the interfaces **404** and **406**. In some embodiments, a zone player **400** includes only the wireless interface **404** or the wired interface **406**.

In some embodiments, the processor **408** is a clock-driven electronic device that is configured to process input data according to instructions stored in memory **410**. The memory **410** is data storage that can be loaded with one or more software modules **414**, which can be executed by the processor **408** to achieve certain tasks. In the illustrated embodiment, the memory **410** is a tangible machine readable medium storing instructions that can be executed by the processor **408**. In some embodiments, a task might be for the zone player **400** to retrieve audio data from another zone player or a device on a network. In some embodiments, a task might be for the zone player **400** to send audio data to another zone player or device on a network. In some embodiments, a task might be for the zone player **400** to synchronize playback of audio with one or more additional zone players. In some embodiments, a task might be to pair the zone player **400** with one or more zone players to create a multi-channel audio environment. Additional or alternative tasks can be achieved via the one or more software modules **414** and the processor **408**.

The audio processing component **412** can include one or more digital-to-analog converters (DAC), an audio preprocessing component, an audio enhancement component or a digital signal processor, and so on. In certain embodiments, the audio that is retrieved via the network interface **402** is processed and/or intentionally altered by the audio processing component **412**. Further, the audio processing component **412** can produce analog audio signals. The processed analog audio signals are then provided to the audio amplifier **416** for play back through speakers **418**. In addition, the audio processing component **412** can include necessary circuitry to process analog or digital signals as inputs to play from zone player **400**, send to another zone player on a network, or both play and send to another zone player on the network. An example input includes a line-in connection (e.g., an auto-detecting 3.5 mm audio line-in connection).

The audio amplifier **416** is a device that amplifies audio signals to a level for driving one or more speakers **418**. The one or more speakers **418** can include an individual transducer (e.g., a "driver") or a complete speaker system that includes an enclosure including one or more drivers. A particular driver can be a subwoofer (for low frequencies), a mid-range driver (middle frequencies), and a tweeter (high frequencies), for example. An enclosure can be sealed or ported, for example.

A zone player **400** can also be referred to herein as a playback device. An example playback device includes a Sonos® Play:5, which is manufactured by Sonos, Inc. of Santa Barbara, Calif. The Play:5 is an example zone player with a built-in amplifier and speakers. In particular, the Play:5 is a five-driver speaker system that includes two tweeters, two mid-range drivers, and one subwoofer. When playing audio content via the Play:5, the left audio data of a track is sent out of the left tweeter and left mid-range driver, the right audio data of a track is sent out of the right tweeter and the right mid-range driver, and mono bass is sent out of the subwoofer. Further, both mid-range drivers and

both tweeters have the same equalization (or substantially the same equalization). That is, they are both sent the same frequencies, just from different channels of audio. Audio from Internet radio stations, online music and video services, downloaded music, analog audio inputs, television, DVD, and so on, can be played from a Sonos® Play:5. While the Play:5 is an example of a zone player with speakers, it is understood that a zone player with speakers is not limited to one with a certain number of speakers (e.g., five speakers as in the Play:5), but rather can contain one or more speakers. Further, a zone player can be part of another device, which might even serve a purpose different than audio (e.g., a lamp).

IV. Example Controller

Referring now to FIG. **5**, there is shown an example controller **500**, which can correspond to the controlling device **130** in FIG. **1**. The controller **500** can be used to facilitate the control of multi-media applications, automation and others in a system. In particular, the controller **500** is configured to facilitate a selection of a plurality of audio sources available on the network and enable control of one or more zone players (e.g., the zone players **102-124** in FIG. **1**) through a wireless network interface **508**. According to one embodiment, the wireless communications is based on an industry standard (e.g., infrared, radio, wireless standards IEEE 802.11a, 802.11b 802.11g, 802.11n, or 802.15). Further, when a particular audio is being accessed via the controller **500** or being played via a zone player, a picture (e.g., album art) or any other data, associated with the audio source can be transmitted from a zone player or other electronic device to the controller **500** for display.

The controller **500** is provided with a screen **502** and an input interface **514** that allows a user to interact with the controller **500**, for example, to navigate a playlist of many multimedia items and to control operations of one or more zone players. The screen **502** on the controller **500** can be an LCD screen, for example. The screen **500** communicates with and is commanded by a screen driver **504** that is controlled by a microcontroller (e.g., a processor) **506**. The memory **510** can be loaded with one or more application modules **512** that can be executed by the microcontroller **506** with or without a user input via the user interface **514** to achieve certain tasks. In some embodiments, an application module **512** is configured to facilitate grouping a number of selected zone players into a zone group and synchronizing the zone players for audio play back. In some embodiments, an application module **512** is configured to control the audio sounds (e.g., volume) of the zone players in a zone group. In operation, when the microcontroller **506** executes one or more ofthe application modules **512**, the screen driver **504** generates control signals to drive the screen **502** to display an application specific user interface accordingly.

The controller **500** includes a network interface **508** that facilitates wireless communication with a zone player. In some embodiments, the commands such as volume control and audio playback synchronization are sent via the network interface **508**. In some embodiments, a saved zone group configuration is transmitted between a zone player and a controller via the network interface **508**. The controller **500** can control one or more zone players, such as **102-124** of FIG. **1**. There can be more than one controller for a particular system. Further, a controller can be integrated into a zone player.

It should be noted that other network-enabled devices such as an iPhone®, iPad® or any other smart phone or network-enabled device (e.g., a networked computer such as a PC or Mac®) can also be used as a controller to interact or control zone players in a particular environment. In some embodiments, a software application or upgrade can be downloaded onto a network enabled device to perform the functions described herein.

In certain embodiments, a user can create a zone group including at least two zone players from the controller **500**. The zone players in the zone group can play audio in a synchronized fashion, such that all of the zone players in the zone group play back an identical audio source or a list of identical audio sources in a synchronized manner such that no (or substantially no) audible delays or hiccups could be heard. Similarly, in some embodiments, when a user increases the audio volume of the group from the controller **500**, the signals or data of increasing the audio volume for the group are sent to one of the zone players and causes other zone players in the group to be increased together in volume.

A user via the controller **500** can group zone players into a zone group by activating a "Link Zones" or "Add Zone" soft button, or de-grouping a zone group by activating an "Unlink Zones" or "Drop Zone" button. For example, one mechanism for 'joining' zone players together for audio play back is to link a number of zone players together to form a group. To link a number of zone players together, a user can manually link each zone player or room one after the other. For example, assume that there is a multi-zone system that includes the following zones: Bathroom, Bedroom, Den, Dining Room, Family Room, and Foyer.

In certain embodiments, a user can link any number of the six zone players, for example, by starting with a single zone and then manually linking each zone to that zone.

In certain embodiments, a set of zones can be dynamically linked together using a command to create a zone scene or theme (subsequent to first creating the zone scene). For instance, a "Morning" zone scene command can link the Bedroom, Office, and Kitchen zones together in one action. Without this single command, the user would need to manually and individually link each zone. The single command might include a mouse click, a double mouse click, a button press, a gesture, or some other programmed action. Other kinds of zone scenes can be programmed.

In certain embodiments, a zone scene can be triggered based on time (e.g., an alarm clock function). For instance, a zone scene can be set to apply at 8:00 am. The system can link appropriate zones automatically, set specific music to play, and then stop the music after a defined duration. Although any particular zone can be triggered to an "On" or "Off" state based on time, for example, a zone scene enables any zone(s) linked to the scene to play a predefined audio (e.g., a favorable song, a predefined playlist) at a specific time and/or for a specific duration. If, for any reason, the scheduled music failed to be played (e.g., an empty playlist, no connection to a share, failed Universal Plug and Play (UPnP), no Internet connection for an Internet Radio station, and so on), a backup buzzer can be programmed to sound. The buzzer can include a sound file that is stored in a zone player, for example.

V. Example Ad-Hoc Network

Certain particular examples will now be provided in connection with FIGS. **6-8**B to describe, for purposes of illustration only, certain base systems and methods to provide and facilitate connection to a playback network. FIG. **6** shows that there are three zone players **602**, **604** and **606** and a controller **608** that form a network branch that is also referred to as an Ad-Hoc network **610**. The network **610** may be wireless, wired, or a combination of wired and wireless. In general, an Ad-Hoc (or "spontaneous") network is a local

area network or other small network in which there is no one access point for all traffic. With an established Ad-Hoc network **610**, the devices **602**, **604**, **606** and **608** can all communicate with each other in a "peer-to-peer" style of communication, for example. Furthermore, devices may come/and go from the network **610**, and the network **610** will automatically reconfigure itself without needing the user to reconfigure the network **610**.

Using the Ad-Hoc network **610**, the devices **602**, **604**, **606**, and **608** can share or exchange one or more audio sources and be grouped to play the same or different audio sources. For example, the devices **602** and **604** are grouped to playback one piece of music, and at the same time, the device **606** plays back another piece of music. In other words, the devices **602**, **604**, **606** and **608**, as shown in FIG. **6**, form a HOUSEHOLD that distributes audio and/or reproduces sound. As used herein, the term HOUSEHOLD (provided in uppercase letters to disambiguate from the user's domicile) is used to represent a collection of networked devices that are cooperating to provide an application or service. An instance of a HOUSEHOLD is identified with a household **10** (or household identifier).

In certain embodiments, a household identifier (HHID) is a short string or an identifier that is computer-generated to help ensure that it is unique. Accordingly, the network **610** can be characterized by a unique HHID and a unique set of configuration variables or parameters, such as channels (e.g., respective frequency bands), SSID (a sequence of alphanumeric characters as a name of a wireless network), and WEP keys (wired equivalent privacy or other security keys). In certain embodiments, SSID is set to be the same as HHID.

In certain embodiments, each HOUSEHOLD includes two types of network nodes: a control point (CP) and a zone player (ZP). The control point controls an overall network setup process and sequencing, including an automatic generation of required network parameters (e.g., WEP keys). In an embodiment, the CP also provides the user with a HOUSEHOLD configuration user interface. The CP function can be provided by a computer running a CP application module, or by a handheld controller (e.g., the controller **308**) also running a CP application module, for example. The zone player is any other device on the network that is placed to participate in the automatic configuration process. The ZP, as a notation used herein, includes the controller **308** or a computing device, for example.

In certain embodiments, configuration of a HOUSEHOLD involves multiple CPs and ZPs that rendezvous and establish a known configuration such that they can use a standard networking protocol (e.g., IP over Wired or Wireless Ethernet) for communication. In an embodiment, two types of networks/protocols are employed: Ethernet 802.3 and Wireless 802.11g. Interconnections between a CP and a ZP can use either of the networks/protocols. A device in the system as a member of a HOUSEHOLD can connect to both networks simultaneously. In an environment that has both networks in use, it is assumed that at least one device in a system is connected to both as a bridging device, thus providing bridging services between wired/wireless networks for others. The zone player **606** in FIG. **6** is shown to be connected to both networks, for example. The connectivity to the network **612** is based on Ethernet while the connectivity to other devices **602**, **604** and **608** is based on Wireless. It is understood, however, that in some embodiments each zone player **606**, **604**, **602** may access the Internet when retrieving media from the cloud (e.g., Internet) via the bridging device. For example, zone player **602** may contain a uniform resource locator (URL) that specifies an address to a particular audio track in the cloud. Using the URL, the zone player **602** may retrieve the audio track from the cloud, and ultimately play the audio out of one or more zone players.

VI. Example Music Sharing and Playback Configuration

Certain embodiments enable a user to stream music from a music-playing application (e.g., browser-based application, native music player, other multimedia application, and so on) to a local multimedia content playback (e.g., Sonos™) system. Certain embodiments provide secure systems and methods for multimedia content playback across a plurality of systems and locations. Certain embodiments facilitate integration between content partners and a playback system as well as supporting maintenance of such content and system.

FIG. **7** shows a system including a plurality of networks including a cloud-based network and at least one local playback network. The network includes a plurality of playback devices or players, though it is understood that the network may contain only one playback device. In certain embodiments, each player has an ability to retrieve its content for playback. Control and content retrieval can be distributed or centralized, for example. Input can include streaming content provider input, third party application input, mobile device input, user input, and/or other playback network input into the cloud for local distribution and playback.

As illustrated by the example system **700** of FIG. **7**, a plurality of content providers **720-750** can be connected to one or more local playback networks **760-770** via a cloud and/or other network **710**. Using the cloud **710**, a multimedia playback system **720** (e.g., Sonos™) a mobile device **730**, a third party application **740**, a retail location **750**, and so on can provide multimedia content (requested or otherwise) to local playback networks **760**, **770**. Within each local network **760**, **770**, a controller **762**, **772** and/or playback device **764**, **774** can provide a song identifier, song name, playlist identifier, playlist name, genre, preference, and so on, and/or simply receive content from a connected system via the cloud.

For example, a user listens to a third party music application (e.g., Pandora™ Rhapsody™, Spotify™, and so on) on her smart phone while commuting. She's enjoying the current channel and, as she walks in the door to her home, selects an option to continue playing that channel on her household music playback system (e.g., Sonos™). The playback system picks up from the same spot on the selected channel that was on her phone and outputs that content (e.g., that song) on speakers and/or other playback devices connected to the household playback system. A uniform resource indicator (URI) (e.g., a uniform resource locator (URL)) can be passed to a playback device to fetch content from a cloud and/or other networked source, for example. A playback device, such as a zone player, can fetch content on its own without use of a controller, for example. Once the zone player has a URL (or some other identification or address) for a song and/or playlist, the zone player can run on its own to fetch the content. Songs and/or other multimedia content can be retrieved from the Internet rather than a local device (e.g., a compact disc (CD)), for example. A third party application can open or utilize an application programming interface (API) to pass music to the household playback system without tight coupling to that household playback system.

In another example of an application determining a playlist and/or other content for playback, a user enjoys listening to music on an online music service (e.g., turntable.fm or

other virtual room that a user can enter to choose from a plurality of online disc jockeys (DJs) deciding what to play next) using his Mac Book Pro™ at home. He likes the unique user experience the service offers, and he frequently hops from room to room discovering new music. To maximize sound quality, he plays the music on his household playback system (e.g., Sonos™). A button or other indicator can be added to the turntable.fm Web application to switch the content being played to the playback system for output (e.g., to the Sonos™ system rather than or in addition to the Mac Book™). While Web-based applications typically do not have access to items on a local network, certain embodiments enable a third-party Web-based application (e.g., Turntable.fm) to talk to a playback system (e.g., Sonos™) in a certain way (e.g., may have to log in with a usemame and password), and the identified user has the website send audio or audio and video down to a playback device (e.g., a zone player) on the playback system local network to play music there (or some other media).

In another example, a first user creates a playlist (e.g., a Spotify™ playlist). The first user visits a second user's house, pulls out her smart phone and shares her playlist by playing it on the second user's household playback (e.g., Sonos™) system using her third party (e.g., Spotify™) application. The first user may also go to the third party content provider's (e.g., Spotify's™) website and share her playlist on the second user's playback system.

Thus, certain embodiments provide cross-service linking such that a song identifier can be passed from one user and/or service to another to be fetched and played. A user having a playlist on his or her phone can visit a friend and, using her account on her friend's system, play a song to which she has an access right. A retrieved song can streamed locally to a user's phone, or an application can pass a song identifier to a local playback system which looks up the song identifier and finds an available audio stream to which the user has a right to play and then plays that song.

In another example, a user is staying in a hotel room or other facility including a local playback network. For example, a speaker and/or other playback device (e.g., a Sonos™ Play:3, Play:5 and so on) in a hotel room can be utilized to play multimedia content to which the user has access from his or her playback network account, streaming audio source, third party application, and so on. Content can be output to one or more devices based on availability, access, configuration, priority, preference, and so on. In certain embodiments, a playback network includes a plurality of nodes, and each node has a capability to play sound in response to an input. Requested output is provided to a most logical connection, for example.

In certain embodiments, a phone device, a television device, and so on can be used to play music, audio, video and/or other multimedia content. In an example, a push button on a microphone or household intercom system to tell the kids dinner is ready is provided over the local playback network.

FIG. **8** shows a flow diagram for a method **800** to provide audio content to a local playback system. In the example method **800** of FIG. **8**, a third party application acts as a "virtual line-in" to the local playback system. At block **810**, streaming of music or other content from a third party application to a local content playback system is triggered. For example, a "Play to Sonos" button is pressed on a Rhapsody™ application. At block **820**, content is streamed to one or more components in a household playback network. The music may be streamed to predetermined zones or players in a household, for example. The music may be further directed to be played in different zones or players throughout the household. Playback on the local network can be facilitated to one or more zones/players based on a configuration (e.g., a zone scene, theme, and so on). Thus, certain embodiments allow a large degree of flexibility in where the music is actually played. For example, the music can be played in the kitchen, the family room, the patio, and so on. Further, the music may be redirected to different zones.

At block **830**, the incoming content (e.g., audio) stream is provided directly from a third party application or other external source to the local playback network for playback. For example, rather than passing track identifiers, an audio stream is provided to a Sonos household system for playback to one or more configured zones. At block **840**, the local playback system consumes the stream and plays it as it would other content on the local playback (e.g., Sonos™) network (e.g., via zones and so on). At block **850**, a playback device (e.g., a zone player, Play:3™, Play:5™, and so on) adds timing information to the streaming content signal (e.g., the device takes the streaming audio signal and repackages it for local synchronized playback). In some embodiments, timing information is not added to the signal unless two or more playback devices are configured to play the audio in synchrony.

FIG. **9** shows a flow diagram for a method **900** to provide audio content to a local playback system. In the example method **900** of FIG. **9**, a uniform resource indicator (URI) handler approach is provided for content output. At block **910**, a link or other reference is embedded in a third party application (e.g., Facebook™ or Twitter). At block **920**, when the link is selected (e.g., clicked), a local playback (e.g., Sonos™) controller, if available, is launched. At block **930**, the application (e.g., accessed on a phone, tablet, computer, and so on) passes a URI for associated content (e.g., an audio track and so on) to a local playback system (e.g., Sonos™) controller. At block **940**, the local controller outputs the associated content (e.g., plays the music) via the URI. For example, music is streamed from the cloud to one or more playback devices on the local playback network.

In certain embodiments, an application associated with the operating system can register to handle all URIs (URLs) that start with a certain prefix and can define how data is encoded into those URLs so a local playback system application can generate a link (e.g., "sonos:") and put that link into a message (e.g., email, text message, instant message (IM), etc.). The local playback application registered to handle such URLs can parse the URLs to determine what song, playlist, streaming radio station, etc., to play. This launches the controller application. For example, if a first listener likes a song and tweets that song, Twitter™ can include a clickable link which launches a playback application and starts the music playing on a local playback system if the local system can find the song (e.g., if have the application, if have rights/access to the song, etc.). In certain embodiments, the system knows to trigger the receiving user's system rather than the sending user's system to play associated content based on the transmitted link/identifier.

For example, an application can register with the system to handle all URLs that start with a custom prefix (e.g., an HTTP "scheme"). For instance, Sonos controller apps can register to handle any URL that begins with "sonos:" or "x-sonos:". In certain embodiments, a playback system provider can define and publish the format of its URLs so that any third party application can create a link or reference to content. A large amount of data can be encoded into a URL using query parameters, for example.

In an example, when an application tries to "open" or "browse" to a URL, the system checks to see if the scheme of the URL matches the "sonos:" scheme that has been registered with the application. If a URL handler application is found, the system launches that application (e.g., the application can but does not need to be running in the background) and passes the URL to the application. The application then parses the URL and executes functionality based on the data in the URL. For example, the URL can contain the name of a music service and a playlist identifier from that service, plus the name of a Sonos™ Zone Player, causing the Sonos controller to start that playlist playing on that zone.

FIG. **10** shows a flow diagram for a method **1000** to provide audio content to a local playback system. In the example method **1000** of FIG. **10**, at block **1010**, a link or other reference is embedded in a third party application (e.g., Facebook™). At block **1020**, when the link is selected, a playback system (e.g., Sonos™) server is contacted and provided with information regarding selected content for playback. For example, rather than launching a local controller application, a server is contacted regarding music for playback on a local network. At block **1030**, using the provided information, the server identifies and provides the content locally on a user's local playback system. For example, the server can then start playing the music directly on the user's Sonos™ system (e.g., without going through a Sonos™ controller application).

In certain embodiments, a "single sign-on" technology is provided so that the user does not need to re-enter a username and password in order to authenticate to the playback server. Example single sign-on technologies include Facebook Connect™, Windows Live ID™, etc.

In certain embodiments, instead of using a specialized link, such as a "sonos:" link, a normal URL can be used to point to a playback system (e.g., Sonos™) webserver, which generates links with special data embedded in the link. A playback system is identified, and content identified by the URL can be playing at via the local playback network (e.g., mesh network configured for home, hotel room, etc.). Parameters such as authentication, security, location, and so on can be configured for local playback of remote content.

FIG. **11** shows a flow diagram for a method **1100** to provide audio content to a local playback system. The example method **1100** of FIG. **11** provides a "throw it over the wall" approach to content delivery to a local playback system. At block **1110**, a third party application provides a multimedia playback device (e.g., a Sonos™ zone player (ZP)) with enough information about content (e.g., an audio track) so that, at block **1120**, the local playback system (e.g., SonosNet™) can directly access a source of the content and, at block **1130**, play the content directly off the network (e.g., the Internet) or cloud.

In certain embodiments, a local playback controller application is not involved. Information passed over to the local playback device may include an identifier for a single track, a playlist, a streaming radio station, a programmed radio station, and so on. This information can also include a current play position within a list to enable near-seamless "handoff" of music from a portable device to a local playback system. Once the music information is handed from the third-party application to the local playback system, there is no further synchronization between the two systems.

A connection between the third-party application and the local playback device (e.g., Sonos ZonePlayer™) can be direct over a local area network (LAN), remote through a proxy server in the cloud, and so on. A LAN delivery approach may be easier to integrate into "native" applications (e.g., applications written for iOS or Android), and a proxy server approach may be easier for third party applications that are browser-based, for example.

In certain embodiments, information is provided from a third party application to a local playback system without being routed through or by a controller application. Here, the third party application is communicating with the multimedia playback device (e.g., a Sonos ZonePlayer™). Information can be passed locally, rather than through the Internet, for example. The local playback device accesses the Internet to find content to stream, and the third party application takes the place of the controller application (e.g., throw it over the wall—the application passes information and the local playback system runs it).

Certain embodiments provide an approach similar to the "throw it over the wall" or one way communication approach of FIG. **11** except that the third party application not only tells the local playback system what to play, but also maintains two-way communication with the local playback (e.g., Sonos™) system. Two-way communication helps enable features such as keeping a local playback queue synchronized with a queue that the user is editing/managing in the third party application; allow the third party application to know what is currently playing on the local playback system; allow integrated transport control between the third party application and the local playback system; and so on.

In certain embodiments, a local playback system can pass information back to a third party application to indicate a current point of playback (e.g., now playing a third song in a playlist, fourth song in the playlist, and so on). The local playback system can pass parameter information, such as a change in volume, from a local multimedia playback device to the third party application so the application can reflect the change in volume to the user via its graphical user interface. The third party application can instruct the local playback system to skip a song, go to a certain location, and so on.

Certain embodiments provide a third party mode that allows users to select from any local playback network (e.g., Sonos™) controller to listen to audio from one or more third party applications on their smartphones or tablets (e.g., Android™ devices). For example, a user may be using a local playback network controller application and now wants a third party application to appear as an audio source within the controller application. The user can then select the controller application that he or she wishes to play audio from the third party application, for example.

Certain embodiments provide queue management to allow a third party application to control a local playback queue. That is, the local playback system has a queue, but the third party application allows users to add, delete and so on from the queue, for example. Rather than switch from content that the user is currently playing, the local playback system allows a user to create a playlist on the fly. For example, if last.fm users vote that they do not like a song and it should be skipped, then the local playback system will skip it.

Certain embodiments allow a third party application to override a local playback queue with its own application-specific queue. The local playback system periodically fetches a short list of tracks to play next. The list of tracks to play is determined by the third-party application, for example. In certain embodiments, a shared queue is provided between the local playback system and the third party application to keep the local system and application synchronized.

Certain embodiments allow control of playback system functions and/or settings via an external (e.g., third party) application. For example, a local playback system can allow volume control, play/pause, and so on and can interact with an application running on a given platform/operating system (OS). Certain embodiments provide a Web API that can be used to access functionality.

Certain embodiments facilitate control of a local playback system from outside a household or other location at which the local playback network is configured. For example, a user can queue up music while away from his or her house. The application can facilitate setup and/or configuration. For example, a third party application may ask the user to enter a Sonos customer email address and password. The application can then make a request to a Sonos server in the cloud to determine the zone groups on which music can be played.

Various inventions have been described in sufficient detail with a certain degree of particularity. It is understood to those skilled in the art that the present disclosure of embodiments has been made by way of examples only and that numerous changes in the arrangement and combination of parts can be resorted without departing from the spirit and scope of the present disclosure as claimed. While the embodiments discussed herein can appear to include some limitations as to the presentation of the information units, in terms of the format and arrangement, the embodiments have applicability well beyond such embodiment, which can be appreciated by those skilled in the art. Accordingly, the scope of the present disclosure is defined by the appended claims rather than the forgoing description of embodiments.

The invention claimed is:

1. A computing device comprising:

at least one processor;

a non-transitory computer-readable medium; and

program instructions stored on the non-transitory computer-readable medium that, when executed by the at least one processor, cause the computing device to perform functions comprising:

operating in a first mode in which the computing device is configured for playback of a remote playback queue provided by a cloud-based computing system associated with a cloud-based media service;

while operating in the first mode, displaying a representation of one or more playback devices in a media playback system that are each i) communicatively coupled to the computing device over a data network and ii) available to accept playback responsibility for the remote playback queue;

while displaying the representation of the one or more playback devices, receiving user input indicating a selection of at least one given playback device from the one or more playback devices;

based on receiving the user input, transmitting an instruction for the at least one given playback device to take over responsibility for playback of the remote playback queue from the computing device, wherein the instruction configures the at least one given playback device to (i) communicate with the cloud-based computing system in order to obtain data identifying a next one or more media items that are in the remote playback queue, (ii) use the obtained data to retrieve at least one media item in the remote playback queue from the cloud-based media service; and (iii) play back the retrieved at least one media item;

detecting an indication that playback responsibility for the remote playback queue has been successfully transferred from the computing device to the at least one given playback device; and

after detecting the indication, transitioning from i) the first mode in which the computing device is configured for playback of the remote playback queue to ii) a second mode in which the computing device is configured to control the at least one given playback device's playback of the remote playback queue and the computing device is no longer configured for playback of the remote playback queue.

2. The computing device of claim **1**, wherein the instruction comprises an instruction for the cloud-based computing system associated with the media service to provide the data identifying the next one or more media items to the given playback device for use in retrieving the at least one media item from the cloud-based computing system associated with the cloud-based media service.

3. The computing device of claim **1**, wherein the instruction comprises an instruction for the cloud-based computing system associated with the cloud-based media service to provide the at least one media item to the given playback device.

4. The computing device of claim **1**, wherein the representation of the one or more playback devices comprises at least one selectable indicator for a group of playback devices that includes the given playback device and one or more other playback devices that are to be configured for synchronous playback of the remote playback queue, and wherein the user input indicating the selection of at least one given playback device from the one or more playback devices comprises user input indicating a selection of the group of playback devices.

5. The computing device of claim **1**, wherein operating in a first mode in which the computing device is configured for playback of the remote playback queue comprises operating in the first mode in which the computing device has received user input indicating a selection of the remote playback queue for playback by the computing device but the computing device has not yet begun playback of the remote playback queue.

6. The computing device of claim **1**, further comprising program instructions stored on the non-transitory computer-readable medium that, when executed by the at least one processor, cause the computing device to perform functions comprising:

beginning to operate in the first mode after i) launching a media application associated with the cloud-based media service and ii) receiving user input indicating a selection of the remote playback queue.

7. The computing device of claim **1**, wherein:

operating in the first mode further involves providing a control interface comprising one or more selectable control icons that are configured to control playback of the remote playback queue by the computing device;

transitioning from the first mode to the second mode further involves modifying the control interface such that the one or more selectable control icons are configured to control playback of the remote playback queue by the at least one playback device instead of the computing device.

8. The computing device of claim **7**, further comprising program instructions stored on the non-transitory computer-readable medium that, when executed by the at least one processor, cause the computing device to perform functions comprising:

after transitioning to the second mode, receiving user input indicating a selection of a given control icon of

the one or more selectable control icons, wherein the given control icon corresponds to a given transport control operation; and

based on receiving the user input indicating the selection of the given control icon, causing the corresponding transport control operation to be executed by the given playback device.

9. The computing device of claim **8**, wherein the transport control operation comprises one of a play operation, a pause operation, a skip forward operation, or a skip back operation.

10. The computing device of claim **1**, wherein the cloud-based computing system associated with the cloud-based media service includes one or more cloud servers.

11. The computing device of claim **1**, wherein displaying the representation of the one or more playback devices comprises:

displaying the representation of the one or more playback devices in response to receiving a selection of a displayed icon indicating that playback responsibility for the remote playback queue can be transferred.

12. A non-transitory computer-readable medium having stored thereon program instructions that, when executed by at least one processor, cause a computing device to perform functions comprising:

operating in a first mode in which the computing device is configured for playback of a remote playback queue provided by a cloud-based computing system associated with a cloud-based media service;

while operating in the first mode, displaying a representation of one or more playback devices in a media playback system that are each i) communicatively coupled to the computing device over a data network and ii) available to accept playback responsibility for the remote playback queue;

while displaying the representation of the one or more playback devices, receiving user input indicating a selection of at least one given playback device from the one or more playback devices;

based on receiving the user input, transmitting an instruction for the at least one given playback device to take over responsibility for playback of the remote playback queue from the computing device, wherein the instruction configures the at least one given playback device to (i) communicate with the cloud-based computing system in order to obtain data identifying a next one or more media items that are in the remote playback queue, (ii) use the obtained data to retrieve at least one media item in the remote playback queue from the cloud-based media service; and (iii) play back the retrieved at least one media item;

detecting an indication that playback responsibility for the remote playback queue has been successfully transferred from the computing device to the at least one given playback device; and

after detecting the indication, transitioning from i) the first mode in which the computing device is configured for playback of the remote playback queue to ii) a second mode in which the computing device is configured to control the at least one given playback device's playback of the remote playback queue and the computing device is no longer configured for playback of the remote playback queue.

13. The non-transitory computer-readable medium of claim **12**, wherein the instruction comprises an instruction for the cloud-based computing system associated with the cloud-based media service to provide the data identifying the next one or more media items to the given playback device for use in obtaining the at least one media item from the cloud-based computing system associated with the cloud-based media service.

14. The non-transitory computer-readable medium of claim **12**, wherein the instruction comprises an instruction for the cloud-based computing system associated with the media service to provide the at least one media item to the given playback device.

15. A method carried out by a computing device, the method comprising:

operating in a first mode in which the computing device is configured for playback of a remote playback queue provided by a cloud-based computing system associated with a cloud-based media service;

while operating in the first mode, displaying a representation of one or more playback devices in a media playback system that are each i) communicatively coupled to the computing device over a data network and ii) available to accept playback responsibility for the remote playback queue;

while displaying the representation of the one or more playback devices, receiving user input indicating a selection of at least one given playback device from the one or more playback devices;

based on receiving the user input, transmitting an instruction for the at least one given playback device to take over responsibility for playback of the remote playback queue from the computing device, wherein the instruction configures the at least one given playback device to (i) communicate with the cloud-based computing system in order to obtain data identifying a next one or more media items that are in the remote playback queue, (ii) use the obtained data to retrieve at least one media item in the remote playback queue from the cloud-based media service; and (iii) play back the retrieved at least one media item;

detecting an indication that playback responsibility for the remote playback queue has been successfully transferred from the computing device to the at least one given playback device; and

after detecting the indication, transitioning from i) the first mode in which the computing device is configured for playback of the remote playback queue to ii) a second mode in which the computing device is configured to control the at least one given playback device's playback of the remote playback queue and the computing device is no longer configured for playback of the remote playback queue.

16. The computing device of claim **1**, further comprising program instructions stored on the non-transitory computer-readable medium that, when executed by the at least one processor, cause the computing device to perform functions comprising:

before displaying the representation of the one or more playback devices, receiving an indication that the one or more playback devices in the media playback system are available to accept playback responsibility for the remote playback queue.

* * * * *

EXHIBIT 3

US009344206B2

(12) **United States Patent**
Lambourne

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(45) **Date of Patent: May 17, 2016**

(54) **METHOD AND APPARATUS FOR UPDATING ZONE CONFIGURATIONS IN A MULTI-ZONE SYSTEM**

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(Continued)

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See application file for complete search history.

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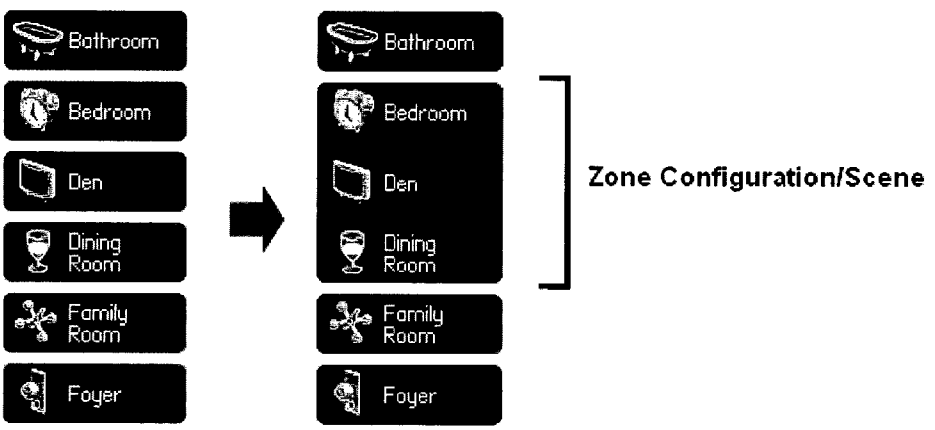
(57) **ABSTRACT**

In general, techniques of controlling a plurality of multimedia players in groups are disclosed. According to one aspect of the present invention, a mechanism is provided to allow a user to group some of the players according to a theme or scene, where each of the players is located in a zone. When the scene is activated, the players in the scene react in a synchronized manner. For example, the players in the scene are all caused to play a multimedia source or music in a playlist, wherein the multimedia source may be located anywhere on a network.

20 Claims, 11 Drawing Sheets



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"Corrected Notice of Allowance mailed on Oct. 30, 2015, issued in connection with U.S. Appl. No. 13/013,740, filed Jan. 25, 2011, 2 pages."

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Notice of Allowance mailed on Oct. 27, 2015, issued in connection with U.S. Appl. No. 14/299,847, filed Jun. 9, 2014, 5 pages.

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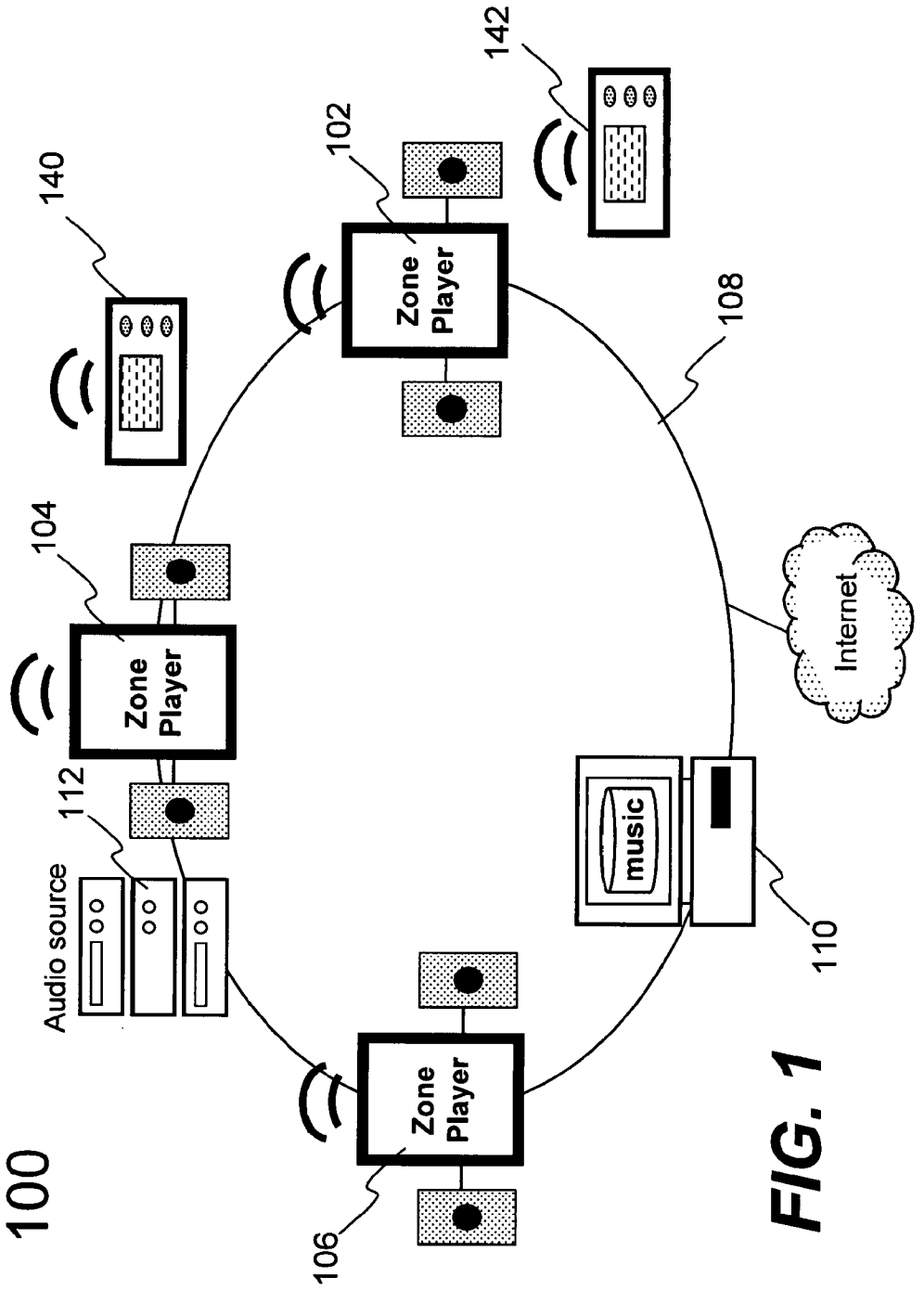

100
140
142
102
104
106
108
110
112
Zone Player
Zone Player
Zone Player
Audio source
music
Internet

FIG. 1

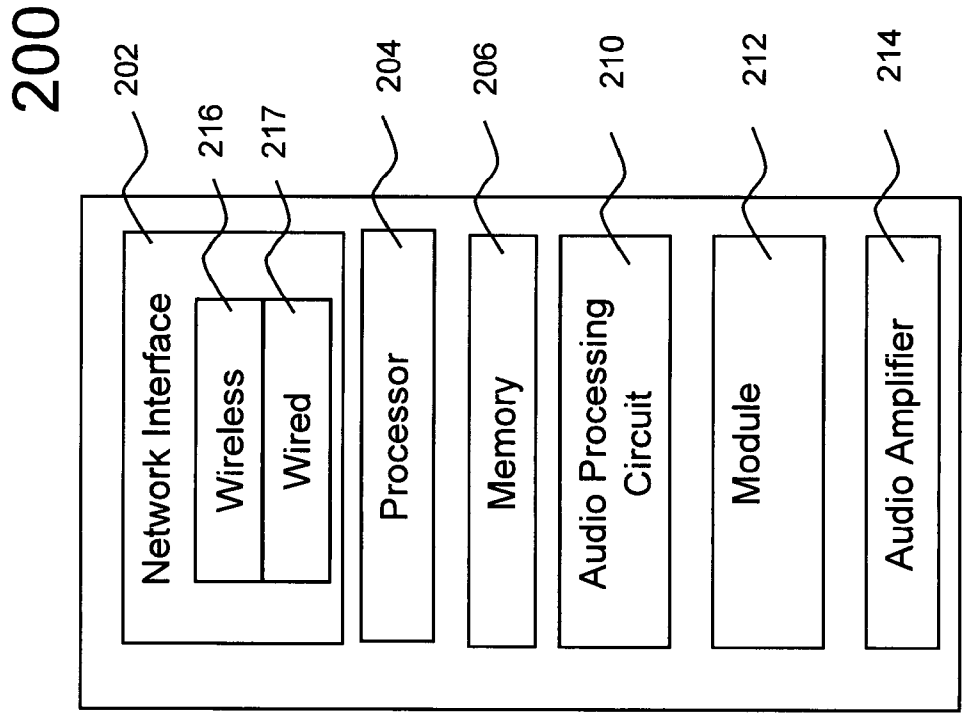

200
202
216
217
204
206
210
212
214
Network Interface
Wireless
Wired
Processor
Memory
Audio Processing Circuit
Module
Audio Amplifier

FIG. 2A

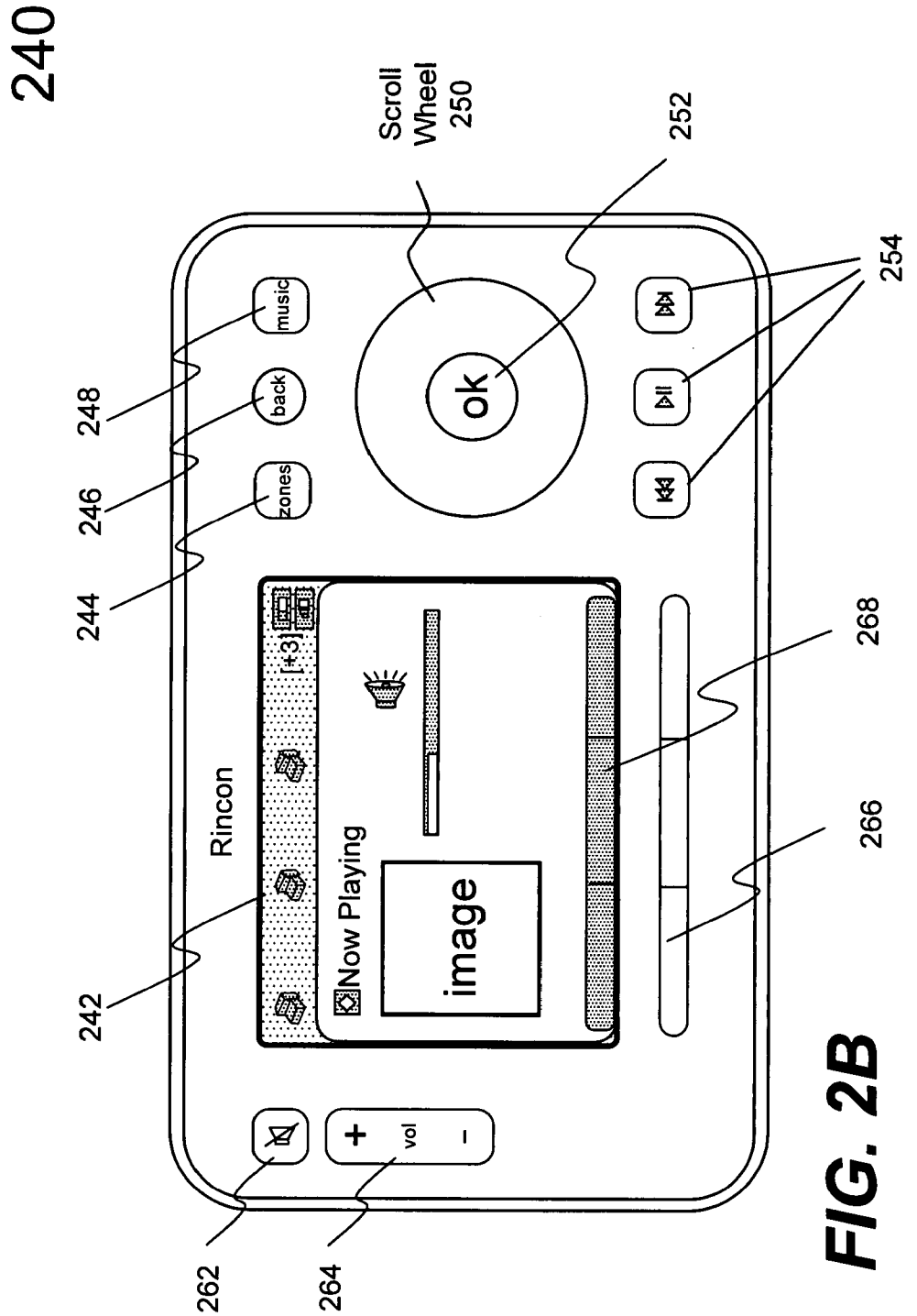

240
Scroll Wheel 250
252
254
248
246
244
242
262
264
268
266
music
back
zones
ok
Rincon
Now Playing
image
vol
+
-

FIG. 2B

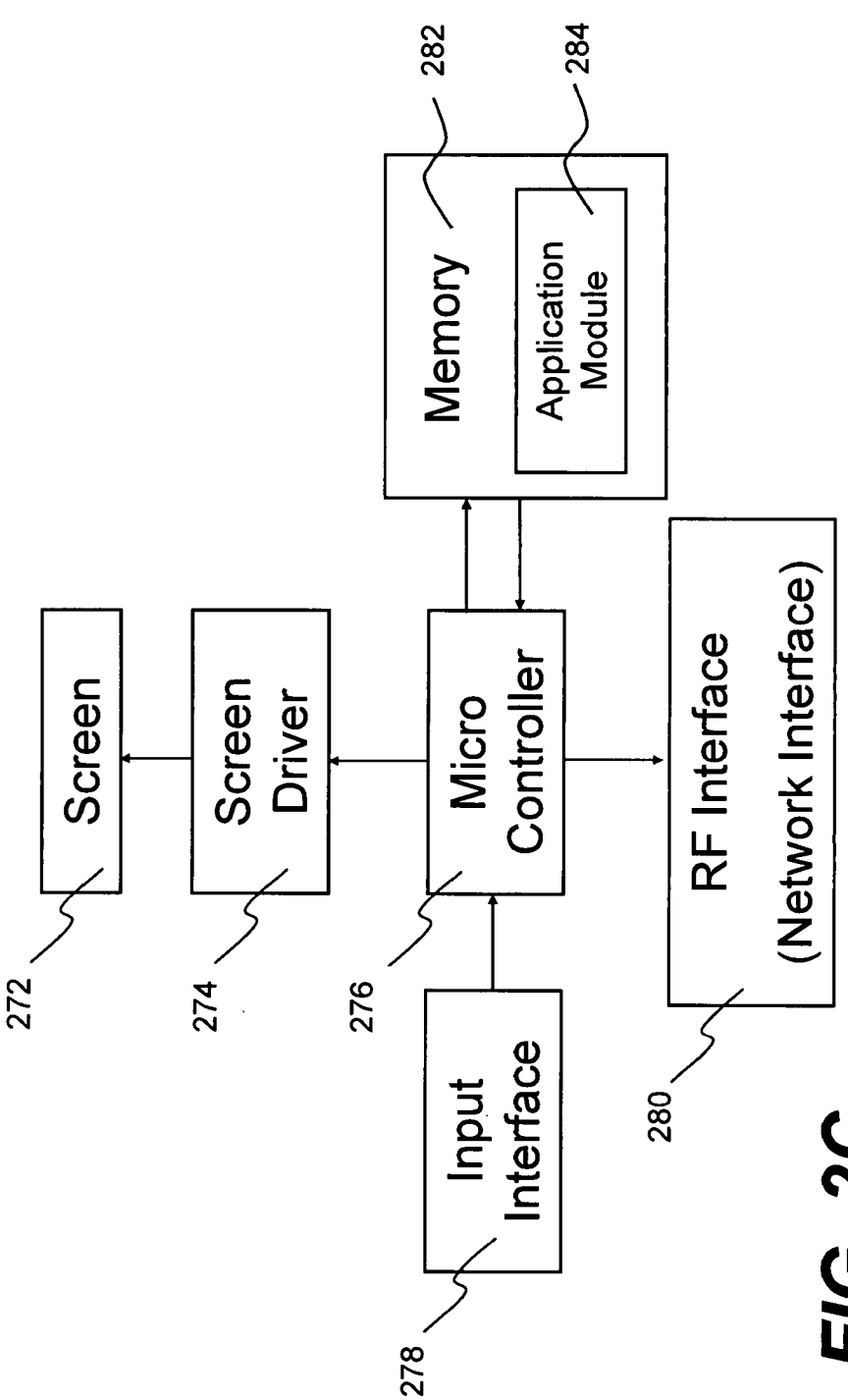

270
282
284
Memory
Application Module
Screen
Screen Driver
Micro Controller
RF Interface (Network Interface)
Input Interface
272
274
276
278
280

FIG. 2C

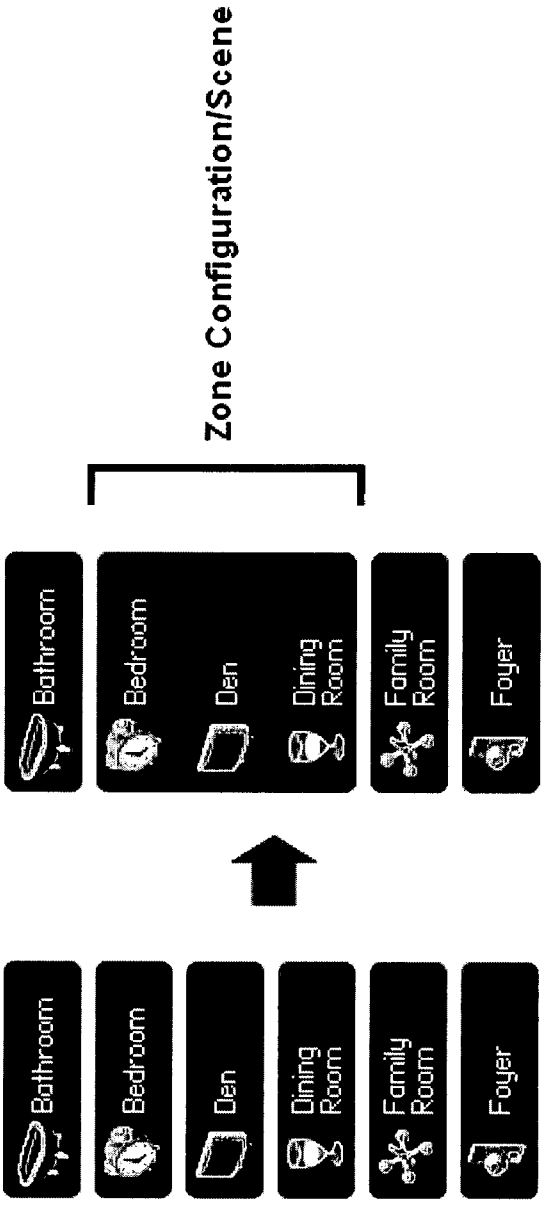
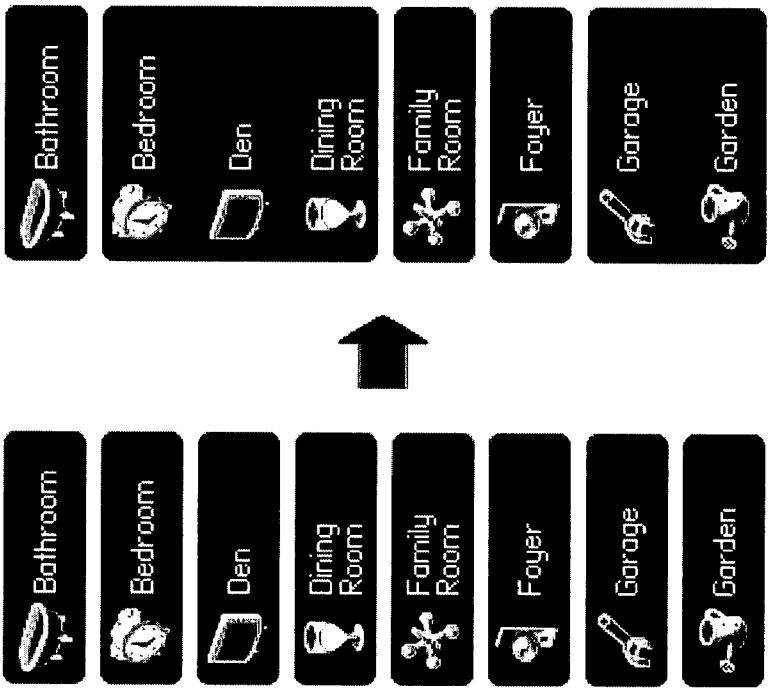

Zone Configuration/Scene
Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer
Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer

FIG. 3A

FIG. 3B


Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer
Garage
Garden
Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer
Garage
Garden

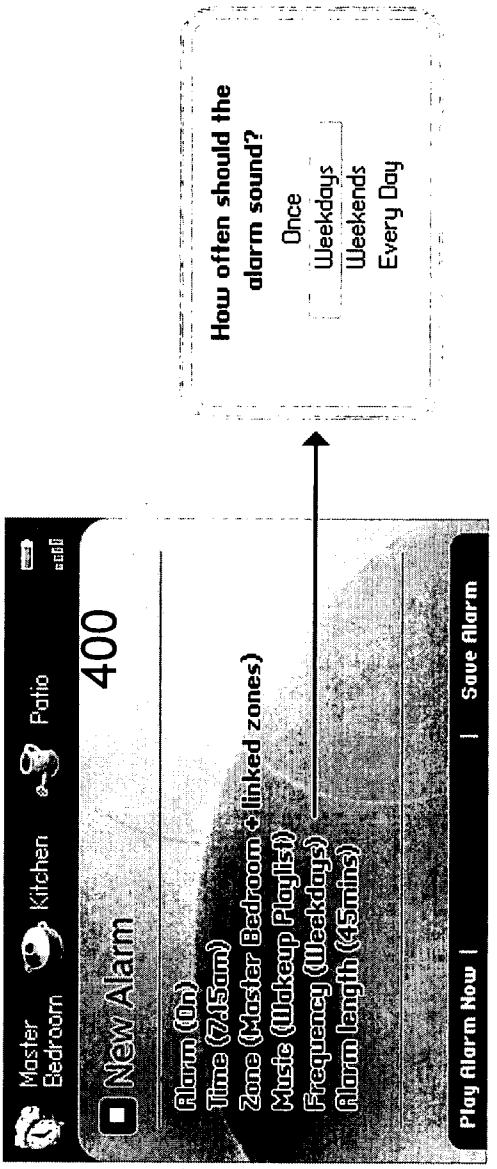

How often should the alarm sound?
Once
Weekdays
Weekends
Every Day
Master Bedroom
Kitchen
Patio
400
New Alarm
Alarm (On)
Time (7:15am)
Zone (Master Bedroom + linked zones)
Music (Wakeup Playlist)
Frequency (Weekdays)
Alarm length (45mins)
Play Alarm Now
Save Alarm

FIG. 4

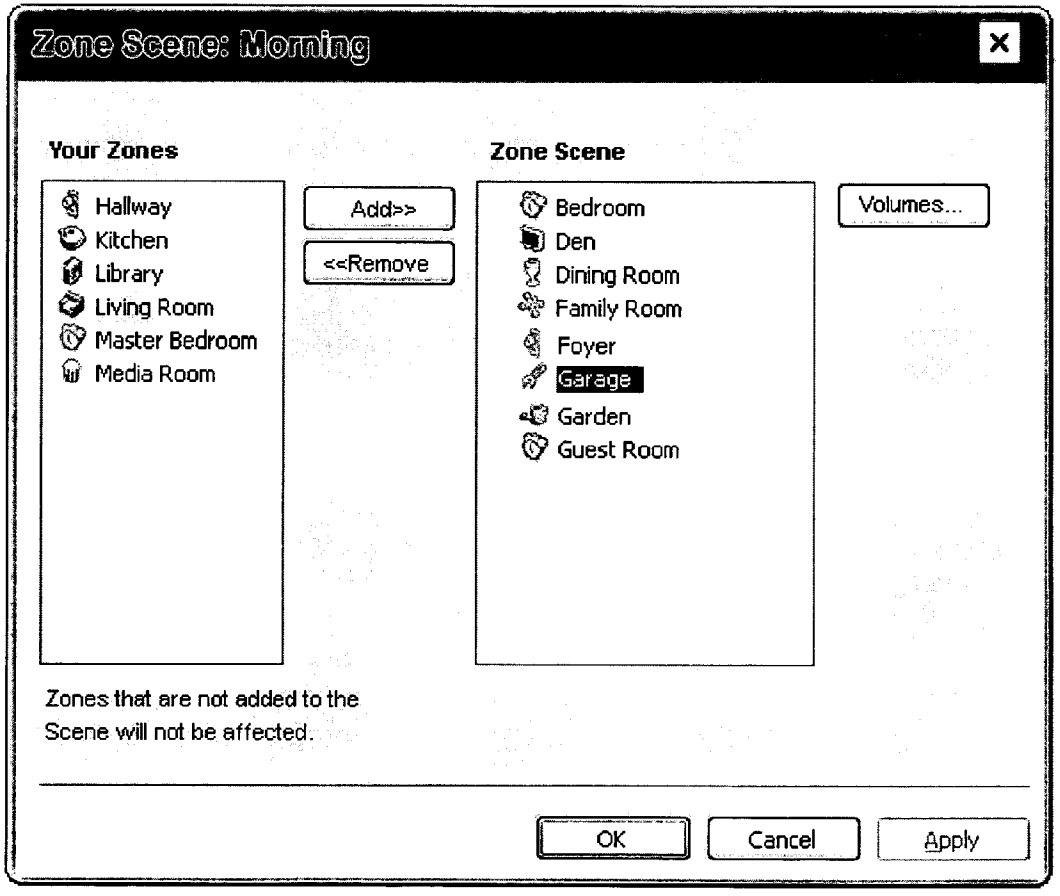

Zone Scene: Morning
500
Your Zones
Hallway
Kitchen
Library
Living Room
Master Bedroom
Media Room
Add>>
<<Remove
Zone Scene
Bedroom
Den
Dining Room
Family Room
Foyer
Garage
Garden
Guest Room
Volumes...
Zones that are not added to the Scene will not be affected.
OK
Cancel
Apply

FIG. 5A

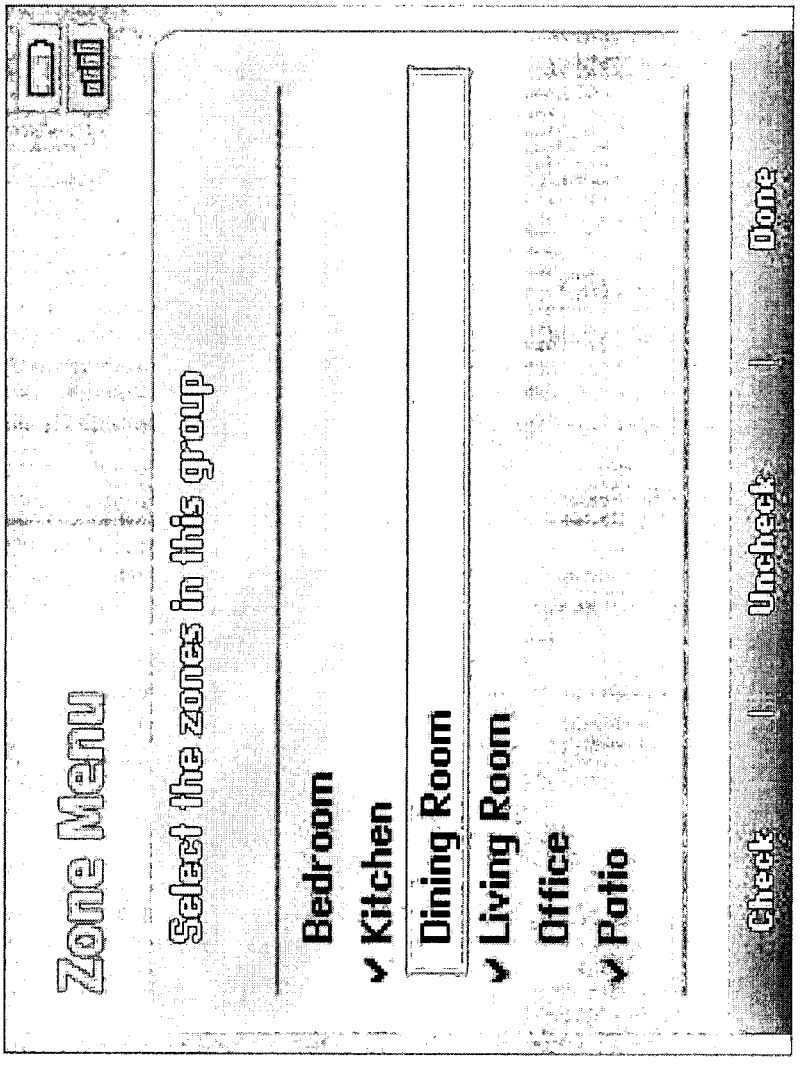

520
Zone Menu
Select the zones in this group
Bedroom
Kitchen
Dining Room
Living Room
Office
Patio
Check
Uncheck
Done

FIG. 5B

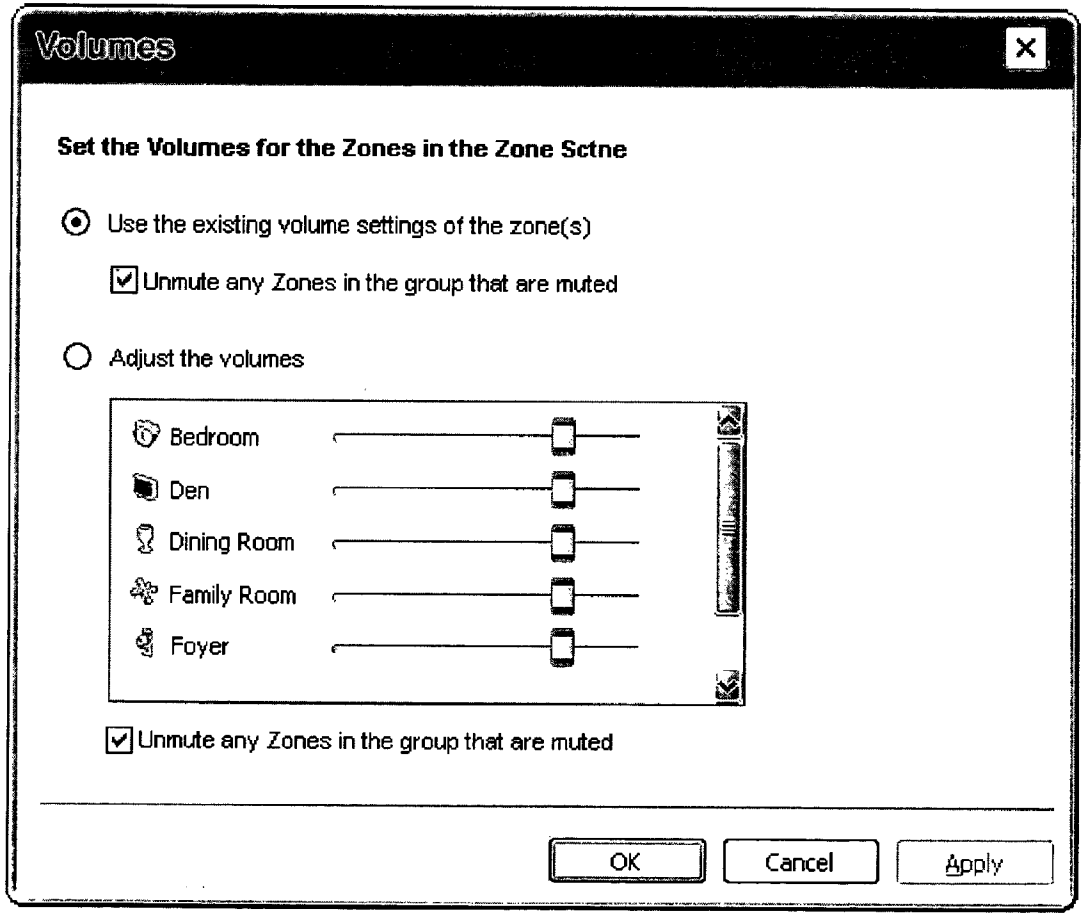

Volumes
510
Set the Volumes for the Zones in the Zone Sctne
Use the existing volume settings of the zone(s)
Unmute any Zones in the group that are muted
Adjust the volumes
Bedroom
Den
Dining Room
Family Room
Foyer
Unmute any Zones in the group that are muted
OK
Cancel
Apply

FIG. 5C

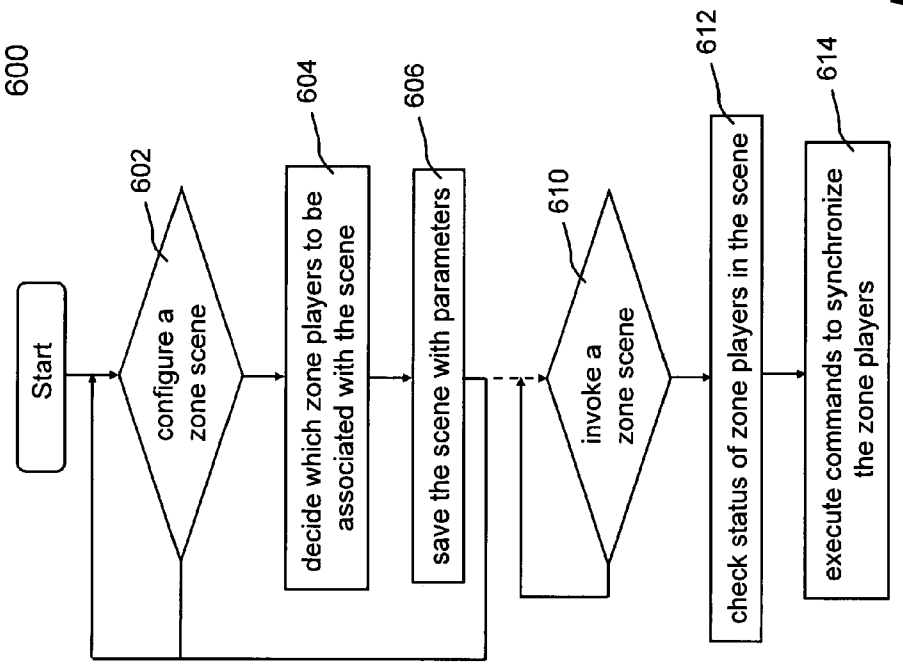

600
Start
602
configure a zone scene
604
decide which zone players to be associated with the scene
606
save the scene with parameters
610
invoke a zone scene
612
check status of zone players in the scene
614
execute commands to synchronize the zone players

FIG. 6

METHOD AND APPARATUS FOR UPDATING ZONE CONFIGURATIONS IN A MULTI-ZONE SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of and claims priority to U.S. patent application Ser. No. 13/896,829, filed on May 17, 2013, entitled "METHOD AND APPARATUS FOR UPDATING ZONE CONFIGURATIONS IN A MULTI-ZONE SYSTEM" and to U.S. patent application Ser. No. 11/853,790, filed Sep. 11, 2007, entitled "CONTROLLING AND MANIPULATING GROUPINGS IN A MULTI-ZONE MEDIA SYSTEM," and U.S. Provisional Application No. 60/825,407 filed on Sep. 12, 2006, entitled "CONTROLLING AND MANIPULATING GROUPINGS IN A MULTI-ZONE MEDIA SYSTEM," each of which is hereby incorporated by reference in its entirety for all purposes.

BACKGROUND OF THE INVENTION

Field of the Invention

The invention is generally related to the area of consumer electronics and human-computer interaction. In particular, the invention is related to method and apparatus for controlling or manipulating a plurality of multimedia players in a multi-zone system.

An enduring passion for quality audio reproduction or system is continuing to drive demands from users. One of the demands includes an audio system in a house in which, for example, one could grill to classic rock on a patio while another one may cook up his/her own music selections in a kitchen. This is all at the same time while a teenager catches a ballgame in a family room, and another one blasts pop in a bedroom. And the best part of such audio system is that each family member does not need his or her own stereo system—one system gives everyone access to all the music sources.

Currently, one of the systems that can meet part of such demand is a conventional multi-zone audio system that usually includes a number of audio players. Each of the audio players has its own amplifier(s) and a set of speakers and typically installed in one place (e.g., a room). In order to play an audio source at one location, the audio source must be provided locally or from a centralized location. When the audio source is provided locally, the multi-zone audio system functions as a collection of many stereo systems, making source sharing difficult. When the audio source is provided centrally, the centralized location may include a juke box, many compact discs, an AM or FM radio, tapes, or others. To send an audio source to an audio player demanding such source, a cross-bar type of device is used to prevent the audio source from going to other audio players that may be playing other audio sources.

In order to achieve playing different audio sources in different audio players, the traditional multi-zone audio system is generally either hard-wired or controlled by a pre-configured and pre-programmed controller. While the pre-programmed configuration may be satisfactory in one situation, it may not be suitable for another situation. For example, a person would like to listen to broadcast news from his/her favorite radio station in a bedroom, a bathroom and a den while preparing to go to work in the morning. The same person may wish to listen in the den and the living room to music from a compact disc in the evening. In order to satisfy such requirements, two groups of audio players must be established. In the morning, the audio players in the bedroom, the bathroom and the den need to be grouped for the broadcast news. In the evening, the audio players in the den and the living room are grouped for the music. Over the weekend, the audio players in the den, the living room, and a kitchen are grouped for party music. Because the morning group, the evening group and the weekend group contain the den, it can be difficult for the traditional system to accommodate the requirement of dynamically managing the ad hoc creation and deletion of groups.

There is a need for dynamic control of the audio players as a group. With a minimum manipulation, the audio players may be readily grouped. In a traditional multi-zone audio system, the audio players have to be adjusted one at a time, resulting in an inconvenient and non-homogenous audio environment. Further, there is a need to individually or systematically adjust the audio volume of the audio players.

SUMMARY OF THE INVENTION

This section is for the purpose of summarizing some aspects of the present invention and to briefly introduce some preferred embodiments. Simplifications or omissions in this section as well as in the abstract or the title of this description may be made to avoid obscuring the purpose of this section, the abstract and the title. Such simplifications or omissions are not intended to limit the scope of the present invention.

In general, the present invention pertains to controlling a plurality of multimedia players, or simply players, in groups. According to one aspect of the present invention, a mechanism is provided to allow a user to group some of the players according to a theme or scene, where each of the players is located in a zone. When the scene is activated, the players in the scene react in a synchronized manner. For example, the players in the scene are all caused to play an audio source or music in a playlist, wherein the audio source may be located anywhere on a network.

According to another aspect of the present invention, the scene may be activated at any time or a specific time. A user may activate the scene at any time so that only some selected zones in an entertainment system facilitate a playback of an audio source. When the scene is activated at a specific time, the scene may be used as an alarm or buzzer.

According to still another aspect of the present invention, a controlling device (also referred to herein as controller) is provided to facilitate a user to select any of the players in the system to form respective groups each of which is set up per a scene. Although various scenes may be saved in any of the members in a group, commands are preferably sent from the controller to the rest of the members when one of the scenes is executed. Depending on implementation, the commands include parameters pertaining to identifiers of the players, volumes settings, audio source and etc.

According to yet another aspect of the present invention, a configurable module is implemented in the controlling device that provides interactive graphic user interface for forming, managing and controlling groups in the system, de-grouping a group or adjusting audio volume of individual players or a group of players.

The present invention may be implemented in many forms including software, hardware or a combination of both. According to one embodiment, the present invention is directed to a method for groupings in a multi-zone media system, the method comprises providing a mechanism to allow a user to determine which players in the system to be associated with a theme representing a group; and configuring the theme with parameters pertaining to the players,

wherein the theme is activated at anytime or a specific time so that the players react in a synchronized manner. The players in a scene are synchronized to play a multimedia file when the scene is activated.

According to another embodiment, the present invention is directed to an entertainment system for grouping players, the system comprises: a plurality of players, each located in one zone; and a controller providing a mechanism to allow a user to select which of the players to be associated with a theme representing a group; and configure the theme with parameters pertaining to the selected players, wherein the theme is activated at anytime or a specific time so that the selected players react in a synchronized manner. As a result, the selected players are synchronized to play a multimedia that is in a digital format and retrieved from a source over a network.

One of the objects, features, and advantages of the present invention is to remotely control a plurality of multimedia players in a multi-zone system, playing and controlling the audio source synchronously if the players are grouped together, or playing and controlling the audio source individually if the players are disassociated with each other.

Other objects, features, and advantages of the present invention will become apparent upon examining the following detailed description of an embodiment thereof, taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. **1** shows an exemplary configuration in which the present invention may be practiced;

FIG. **2**A shows an exemplary functional block diagram of a player in accordance with the present invention;

FIG. **2**B shows an example of a controller that may be used to remotely control one of more players of FIG. **2**A;

FIG. **2**C shows an exemplary internal functional block diagram of a controller in accordance with one embodiment of the present invention;

FIG. **3**A provides an illustration of one zone scene, where the left column shows the starting zone grouping—all zones are separate, the column on the right shows the effects of grouping the zones to make a group of 3 zones named after "Morning";

FIG. **3**B shows that a user defines multiple groups to be gathered at the same time;

FIG. **4** shows an exemplary user interface that may be displayed on a controller or a computer of FIG. **1**;

FIG. **5**A shows a user interface to allow a user to form a scene;

FIG. **5**B shows another user interface **520** to allow a user to form a scene;

FIG. **5**C shows a user interface to allow a user to adjust a volume level of the zone players in a zone scene individually or collectively; and

FIG. **6** shows a flowchart or process of providing a player theme or a zone scene for a plurality of players, where one or more of the players are placed in a zone.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The detailed description of the invention is presented largely in terms of procedures in terms of procedures, steps, logic blocks, processing, and other symbolic representations that directly or indirectly resemble the operations of data processing devices coupled to networks. These process descriptions and representations are typically used by those skilled in the art to most effectively convey the substance of their work to others skilled in the art. Numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will become obvious to those skilled in the art that the present invention may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuitry have not been described in detail to avoid unnecessarily obscuring aspects of the present invention.

Reference herein to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Further, the order of blocks in process flowcharts or diagrams representing one or more embodiments of the invention do not inherently indicate any particular order nor imply any limitations in the invention.

Referring now to the drawings, in which like numerals refer to like parts throughout the several views. FIG. **1** shows an exemplary configuration **100** in which the present invention may be practiced. The configuration may represent, but not be limited to, a part of a residential home, a business building or a complex with multiple zones. There are a number of multimedia players of which three examples **102**, **104** and **106** are shown as audio devices. Each of the audio devices may be installed or provided in one particular area or zone and hence referred to as a zone player herein.

As used herein, unless explicitly stated otherwise, an audio source or audio sources are in digital format and can be transported or streamed over a data network. To facilitate the understanding of the present invention, it is assumed that the configuration **100** represents a home. Thus, the zone player **102** and **104** may be located in two of the bedrooms respectively while the zone player **106** may be installed in a living room. All of the zone players **102**, **104** and **106** are coupled directly or indirectly to a data network **108**. In addition, a computing device **110** is shown to be coupled on the network **108**. In reality, any other devices such as a home gateway device, a storage device, or an MP3 player may be coupled to the network **108** as well.

The network **108** may be a wired network, a wireless network or a combination of both. In one example, all devices including the zone players **102**, **104** and **106** are coupled to the network **108** by wireless means based on an industry standard such as IEEE 802.11. In yet another example, all devices including the zone players **102**, **104** and **106** are part of a local area network that communicates with a wide area network (e.g., the Internet).

Many devices on the network **108** are configured to download and store audio sources. For example, the computing device **110** can download audio sources from the Internet and store the downloaded sources locally for sharing with other devices on the Internet or the network **108**. The computing device **110** or any of the zone players can also be configured to receive streaming audio. Shown as a stereo system, the device **112** is configured to receive an analog audio source (e.g., from broadcasting) or retrieve a digital audio source (e.g., from a compact disk). The analog audio sources can be

converted to digital audio sources. In accordance with the present invention, the audio source may be shared among the devices on the network **108**.

Two or more zone players may be grouped together to form a new zone group. Any combinations of zone players and an existing zone group may be grouped together. In one instance, a new zone group is formed by adding one zone player to another zone player or an existing zone group.

Referring now to FIG. **2**A, there is shown an exemplary functional block diagram of a zone player **200** in accordance with the present invention. The zone player **200** includes a network interface **202**, a processor **204**, a memory **206**, an audio processing circuit **210**, a module **212**, and optionally, an audio amplifier **214** that may be internal or external. The network interface **202** facilitates a data flow between a data network (i.e., the data network **108** of FIG. **1**) and the zone player **200** and typically executes a special set of rules (i.e., a protocol) to send data back and forth. One of the common protocols used in the Internet is TCP/IP (Transmission Control Protocol/Internet Protocol). In general, a network interface manages the assembling of an audio source or file into smaller packets that are transmitted over the data network or reassembles received packets into the original source or file. In addition, the network interface **202** handles the address part of each packet so that it gets to the right destination or intercepts packets destined for the zone player **200**.

The network interface **202** may include one or both of a wireless interface **216** and a wired interface **217**. The wireless interface **216**, also referred to as a RF interface, provides network interface functions by a wireless means for the zone player **200** to communicate with other devices in accordance with a communication protocol (such as the wireless standard IEEE 802.11a, 802.11b or 802.11g). The wired interface **217** provides network interface functions by a wired means (e.g., an Ethernet cable). In one embodiment, a zone player includes both of the interfaces **216** and **217**, and other zone players include only a RF or wired interface. Thus these other zone players communicate with other devices on a network or retrieve audio sources via the zone player. The processor **204** is configured to control the operation of other parts in the zone player **200**. The memory **206** may be loaded with one or more software modules that can be executed by the processor **204** to achieve desired tasks. According to one aspect of the present invention, a software module implementing one embodiment of the present invention is executed, the processor **204** operates in accordance with the software module in reference to a saved zone group configuration characterizing a zone group created by a user, the zone player **200** is caused to retrieve an audio source from another zone player or a device on the network.

According to one embodiment of the present invention, the memory **206** is used to save one or more saved zone configuration files that may be retrieved for modification at any time. Typically, a saved zone group configuration file is transmitted to a controller (e.g., the controlling device **140** or **142** of FIG. **1**, a computer, a portable device, or a TV) when a user operates the controlling device. The zone group configuration provides an interactive user interface so that various manipulations or control of the zone players may be performed.

The audio processing circuit **210** resembles most of the circuitry in an audio playback device and includes one or more digital-to-analog converters (DAC), an audio preprocessing part, an audio enhancement part or a digital signal processor and others. In operation, when an audio source is retrieved via the network interface **202**, the audio source is processed in the audio processing circuit **210** to produce analog audio signals. The processed analog audio signals are then provided to the audio amplifier **214** for playback on speakers. In addition, the audio processing circuit **210** may include necessary circuitry to process analog signals as inputs to produce digital signals for sharing with other devices on a network.

Depending on an exact implementation, the module **212** may be implemented as a combination of hardware and software. In one embodiment, the module **212** is used to save a scene. The audio amplifier **214** is typically an analog circuit that powers the provided analog audio signals to drive one or more speakers.

Referring now to FIG. **2**B, there is shown an exemplary controller **240**, which may correspond to the controlling device **140** or **142** of FIG. **1**. The controller **240** may be used to facilitate the control of multi-media applications, automation and others in a complex. In particular, the controller **240** is configured to facilitate a selection of a plurality of audio sources available on the network, controlling operations of one or more zone players (e.g., the zone player **200**) through a RF interface corresponding to the RF interface **216** of FIG. **2**A. According to one embodiment, the wireless means is based on an industry standard (e.g., infrared, radio, wireless standard IEEE 802.11a, 802.11b or 802.11g). When a particular audio source is being played in the zone player **200**, a picture, if there is any, associated with the audio source may be transmitted from the zone player **200** to the controller **240** for display. In one embodiment, the controller **240** is used to synchronize more than one zone players by grouping the zone players in a group. In another embodiment, the controller **240** is used to control the volume of each of the zone players in a zone group individually or together.

The user interface for the controller **240** includes a screen **242** (e.g., a LCD screen) and a set of functional buttons as follows: a "zones" button **244**, a "back" button **246**, a "music" button **248**, a scroll wheel **250**, "ok" button **252**, a set of transport control buttons **254**, a mute button **262**, a volume up/down button **264**, a set of soft buttons **266** corresponding to the labels **268** displayed on the screen **242**.

The screen **242** displays various screen menus in response to a user's selection. In one embodiment, the "zones" button **244** activates a zone management screen or "Zone Menu", which is described in more details below. The "back" button **246** may lead to different actions depending on the current screen. In one embodiment, the "back" button triggers the current screen display to go back to a previous one. In another embodiment, the 'back" button negates the user's erroneous selection. The "music" button **248** activates a music menu, which allows the selection of an audio source (e.g., a song) to be added to a zone player's music queue for playback.

The scroll wheel **250** is used for selecting an item within a list, whenever a list is presented on the screen **242**. When the items in the list are too many to be accommodated in one screen display, a scroll indicator such as a scroll bar or a scroll arrow is displayed beside the list. When the scroll indicator is displayed, a user may rotate the scroll wheel **250** to either choose a displayed item or display a hidden item in the list. The "ok" button **252** is used to confirm the user selection on the screen **242**.

There are three transport buttons **254**, which are used to control the effect of the currently playing song. For example, the functions of the transport buttons may include play/pause and forward/rewind a song, move forward to a next song track, or move backward to a previous track. According to one embodiment, pressing one of the volume control buttons such as the mute button **262** or the volume up/down button **264** activates a volume panel. In addition, there are three soft buttons **266** that can be activated in accordance with the labels

268 on the screen 242. It can be understood that, in a multi-zone system, there may be multiple audio sources being played respectively in more than one zone players. The music transport functions described herein shall apply selectively to one of the sources when a corresponding one of the zone players or zone groups is selected.

FIG. 2C illustrates an internal functional block diagram of an exemplary controller 270, which may correspond to the controller 240 of FIG. 2B. The screen 272 on the controller 270 may be a LCD screen. The screen 272 communicates with and is commanded by a screen driver 274 that is controlled by a microcontroller (e.g., a processor) 276. The memory 282 may be loaded with one or more application modules 284 that can be executed by the microcontroller 276 with or without a user input via the user interface 278 to achieve desired tasks. In one embodiment, an application module is configured to facilitate grouping a number of selected zone players into a zone group and synchronizing the zone players for one audio source. In another embodiment, an application module is configured to control together the audio volumes of the zone players in a zone group. In operation, when the microcontroller 276 executes one of the application modules 284, the screen driver 274 generates control signals to drive the screen 272 to display an application specific user interface accordingly, more of which will be described below.

The controller 270 includes a network interface 280 referred to as a RF interface 280 that facilitates wireless communication with a zone player via a corresponding RF interface thereof. In one embodiment, the commands such as volume control and audio playback synchronization are sent via the RF interfaces. In another embodiment, a saved zone group configuration is transmitted between a zone player and a controller via the RF interfaces. The controller 270 may control one or more zone players, such as 102, 104 and 106 of FIG. 1. Nevertheless, there may be more than one controllers, each preferably in a zone (e.g., a room) and configured to control any one and all of the zone players.

In one embodiment, a user creates a zone group including at least two zone players from the controller 240 that sends signals or data to one of the zone players. As all the zone players are coupled on a network, the received signals in one zone player can cause other zone players in the group to be synchronized so that all the zone players in the group playback an identical audio source or a list of identical audio sources in a timely synchronized manner. Similarly, when a user increases the audio volume of the group from the controller, the signals or data of increasing the audio volume for the group are sent to one of the zone players and causes other zone players in the group to be increased together in volume and in scale.

According to one implementation, an application module is loaded in memory 282 for zone group management. When a predetermined key (e.g. the "zones" button 244) is activated on the controller 240, the application module is executed in the microcontroller 276. The input interface 278 coupled to and controlled by the microcontroller 276 receives inputs from a user. A "Zone Menu" is then displayed on the screen 272. The user may start grouping zone players into a zone group by activating a "Link Zones" or "Add Zone" soft button, or de-grouping a zone group by activating an "Unlink Zones" or "Drop Zone" button. The detail of the zone group manipulation will be further discussed below.

As described above, the input interface 278 includes a number of function buttons as well as a screen graphical user interface. It should be pointed out that the controller 240 in FIG. 2B is not the only controlling device that may practice the present invention. Other devices that provide the equivalent control functions (e.g., a computing device, a hand-held device) may also be configured to practice the present invention. In the above description, unless otherwise specifically described, it is clear that keys or buttons are generally referred to as either the physical buttons or soft buttons, enabling a user to enter a command or data.

One mechanism for 'joining' zone players together for music playback is to link a number of zone players together to form a group. To link a number of zone players together, a user may manually link each zone player or room one after the other. For example, there is a multi-zone system that includes the following zones.

Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer

If the user wishes to link 5 of the 6 zone players using the current mechanism, he/she must start with a single zone and then manually link each zone to that zone. This mechanism may be sometimes quite time consuming. According to one embodiment, a set of zones can be dynamically linked together using one command. Using what is referred to herein as a theme or a zone scene, zones can be configured in a particular scene (e.g., morning, afternoon, or garden), where a predefined zone grouping and setting of attributes for the grouping are automatically effectuated.

For instance, a "Morning" zone scene/configuration command would link the Bedroom, Den and Dining Room together in one action. Without this single command, the user would need to manually and individually link each zone. FIG. 3A provides an illustration of one zone scene, where the left column shows the starting zone grouping—all zones are separate, the column on the right shows the effects of grouping the zones to make a group of 3 zones named after "Morning".

Expanding this idea further, a Zone Scene can be set to create multiple sets of linked zones. For example, a scene creates 3 separate groups of zones, the downstairs zones would be linked together, the upstairs zones would be linked together in their own group, and the outside zones (in this case the patio) would move into a group of its own.

In one embodiment as shown in FIG. 3B, a user defines multiple groups to be gathered at the same time. For example: an "Evening Scene" is desired to link the following zones:

Group 1
Bedroom
Den
Dining Room
Group 2
Garage
Garden

where Bathroom, Family Room and Foyer should be separated from any group if they were part of a group before the Zone Scene was invoked.

One important of the features, benefits and objects in the present invention is that that zones do not need to be separated before a zone scene is invoked. In one embodiment, a command is provided and links all zones in one step, if invoked. The command is in a form of a zone scene. After linking the appropriate zones, a zone scene command could apply the following attributes:

Set volumes levels in each zones (each zone can have a different volume) Mute/Unmute zones.
Select and play specific music in the zones.
Set the play mode of the music (Shuffle, Repeat, Shuffle-repeat)

Set the music playback equalization of each zone (e.g., bass treble).

A further extension of this embodiment is to trigger a zone scene command as an alarm clock function. For instance the zone scene is set to apply at 8:00 am. It could link appropriate zones automatically, set specific music to play and then stop the music after a defined duration. Although a single zone may be assigned to an alarm, a scene set as an alarm clock provides a synchronized alarm, allowing any zones linked in the scene to play a predefined audio (e.g., a favorable song, a predefined playlist) at a specific time or for a specific duration. If, for any reason, the scheduled music failed to be played (e.g., an empty playlist, no connection to a share, failed UPnP, no Internet connection for an Internet Radio station), a backup buzzer will sound. This buzzer will be a sound file that is stored in a zone player.

FIG. **4** shows an exemplary user interface **400** that may be displayed on a controller **142** or a computer **110** of FIG. **1**. The interface **400** shows a list of items that may be set up by a user to cause a scene to function at a specific time. In the embodiment shown in FIG. **4**, the list of items includes "Alarm", "Time", "Zone", "Music", "Frequency" and "Alarm length". "Alarm" can be set on or off. When "Alarm" is set on, "Time" is a specific time to set off the alarm. "Zone" shows which zone players are being set to play a specified audio at the specific time. "Music" shows what to be played when the specific time arrives. "Frequency" allows the user to define a frequency of the alarm. "Alarm length" defines how long the audio is to be played. It should be noted that the user interface **400** is provided herein to show some of the functions associated with setting up an alarm. Depending on an exact implementation, other functions, such as time zone, daylight savings, time synchronization, and time/date format for display may also be provided without departing from the present invention.

According to one embodiment, each zone player in a scene may be set up for different alarms. For example, a "Morning" scene includes three zone players, each in a bedroom, a den, and a dining room. After selecting the scene, the user may set up an alarm for the scene as whole. As a result, each of the zone players will be activated at a specific time.

FIG. **5**A shows a user interface **500** to allow a user to form a scene. The panel on the left shows the available zones in a household. The panel on the right shows the zones that have been selected and be grouped as part of this scene. Depending on an exact implementation of a user interface, Add/Remove buttons may be provided to move zones between the panels, or zones may be dragged along between panels.

FIG. **5**B shows another user interface **520** to allow a user to form a scene. The user interface **520** that may be displayed on a controller or a computing device, lists available zones in a system. A checkbox is provide next to each of the zones so that a user may check in the zones to be associated with the scene.

FIG. **5**C shows a user interface **510** to allow a user to adjust a volume level of the zone players in a zone scene individually or collectively. As shown in the user interface **510**, the 'Volumes . . . ' button (shown as sliders, other forms are possible) allows the user to affect the volumes of the associated zone players when a zone scene is invoked. In one embodiment, the zone players can be set to retain whatever volume that they currently have when the scene is invoked. Additionally the user can decide if the volumes should be unmuted or muted when the scene is invoked.

FIG. **6** shows a flowchart or process **600** of providing a player theme or a zone scene for a plurality of players, where one or more of the players are placed in a zone. The process **600** is presented in accordance with one embodiment of the present invention and may be implemented in a module to be located in the memory **282** of FIG. **2**C.

The process **600** is initiated only when a user decides to proceed with a zone scene at **602**. The process **600** then moves to **604** where it allows a user to decide which zone players to be associated with the scene. For example, there are ten players in a household, and the scene is named after "Morning". The user may be given an interface to select four of the ten players to be associated with the scene. At **606**, the scene is saved. The scene may be saved in any one of the members in the scene. In the example of FIG. **1**, the scene is saved in one of the zone players and displayed on the controller **142**. In operation, a set of data pertaining to the scene includes a plurality of parameters. In one embodiment, the parameters include, but may not be limited to, identifiers (e.g., IP address) of the associated players and a playlist. The parameters may also include volume/tone settings for the associated players in the scene. The user may go back to **602** to configure another scene if desired.

Given a saved scene, a user may activate the scene at any time or set up a timer to activate the scene at **610**. The process **600** can continue when a saved scene is activated at **610**. At **612**, upon the activation of a saved scene, the process **600** checks the status of the players associated with the scene. The status of the players means that each of the players shall be in condition to react in a synchronized manner. In one embodiment, the interconnections of the players are checked to make sure that the players communicate among themselves and/or with a controller if there is such a controller in the scene.

It is assumed that all players associated with the scene are in good condition. At **614**, commands are executed with the parameters (e.g., pertaining to a playlist and volumes). In one embodiment, data including the parameters is transported from a member (e.g., a controller) to other members in the scene so that the players are caused to synchronize an operation configured in the scene. The operation may cause all players to play back a song in identical or different volumes or to play back a pre-stored file.

One of the features, benefits and advantages in the present invention is to allow sets of related devices (controllers and operating components) to exist as a group without interfering with other components that are potentially visible on the same wired or wireless network. Each of the sets is configured to a theme or a scene.

The present invention has been described in sufficient detail with a certain degree of particularity. It is understood to those skilled in the art that the present disclosure of embodiments has been made by way of examples only and that numerous changes in the arrangement and combination of parts may be resorted without departing from the spirit and scope of the invention as claimed. While the embodiments discussed herein may appear to include some limitations as to the presentation of the information units, in terms of the format and arrangement, the invention has applicability well beyond such embodiment, which can be appreciated by those skilled in the art. Accordingly, the scope of the present invention is defined by the appended claims rather than the forgoing description of embodiments.

The invention claimed is:

1. A multimedia controller including a processor, the controller configured to:

receive, via a network interface, a zone configuration from a first independent playback device of a plurality of independent playback devices, wherein the zone configuration is configured via the controller and maintained at the first independent playback device, and

wherein the zone configuration characterizes one or more zone scenes, each zone scene identifying a group configuration associated with two or more of the plurality of independent playback devices; and

cause a selectable indication of the received zone configuration to be displayed, wherein the displayed selectable indication is selectable to cause one or more of the zone scenes to be invoked by two or more of the plurality of independent playback devices.

2. The multimedia controller of claim **1**, wherein causing the selectable indication of the received zone configuration to be displayed comprises causing an indication of at least one of the one or more zone scenes to be displayed.

3. The multimedia controller of claim **2**, wherein causing the selectable indication of the at least one of the one or more zone scenes to be displayed comprises displaying an indication of the group configuration identified by the at least one of the one or more zone scenes to be displayed.

4. The multimedia controller of claim **3**, wherein the indication of the group configuration identified by the at least one of the one or more zone scenes comprises one group of independent playback devices.

5. The multimedia controller of claim **4**, further configured to:

after causing the indication of the received zone configuration to be displayed, cause one of the at least one of the one or more zone scenes to be activated.

6. The multimedia controller of claim **3**, wherein the indication of the group configuration identified by the at least one of the one or more zone scenes comprises two or more groups of independent playback devices.

7. The multimedia controller claim **1**, further configured to:

before receiving the zone configuration, send, to one of the plurality of independent playback devices, a command to save at least one of the one or more zone scenes.

8. The multimedia controller of claim **7**, wherein the command to save at least one of the one or more zone scenes includes, for each of the at least one or more zone scenes, (a) an indication of the two or more of the plurality of independent playback devices identified by the zone scene and (b) at least one other parameter pertaining to the scene.

9. The multimedia controller of claim **8**, wherein the at least one other parameter pertaining to the scene is one or more of (i) a volume level, (ii) a specific music, (iii) a play mode, or (iv) an equalization.

10. The multimedia controller of claim **1**, further configured to:

after causing the selectable indication of the received zone configuration to be displayed, cause at least one of the one or more zone scenes to be activated.

11. The multimedia controller of claim **1**, wherein each of the one or more zone scenes is associated with a name.

12. In a network comprising a plurality of independent playback devices, a method comprising:

receiving, via the network by a controller device, a zone configuration from a first independent playback device of a plurality of independent playback devices, wherein the zone configuration is configured via the controller and maintained at the first independent playback device,

and wherein the zone configuration characterizes one or more zone scenes, each zone scene identifying a group configuration associated with two or more of the plurality of independent playback devices; and

causing, by the controller device, a selectable indication of the received zone configuration to be displayed, wherein the displayed selectable indication is selectable to cause one or more of the zone scenes to be invoked by two or more of the plurality of independent playback devices.

13. The method of claim **12**, wherein causing the selectable indication of the received zone configuration to be displayed comprises causing an indication of at least one of the one or more zone scenes to be displayed.

14. The method of claim **13**, wherein causing the selectable indication of the at least one of the one or more zone scenes to be displayed comprises displaying an indication of the group configuration identified by the at least one of the one or more zone scenes to be displayed.

15. The method of claim **12**, further comprising:

before receiving the zone configuration, sending, to one of the plurality of independent playback devices, a command to save at least one of the one or more zone scenes.

16. The method of claim **12**, further comprising:

after causing the selectable indication of the received zone configuration to be displayed, causing, by the controller device, at least one of the one or more zone scenes to be activated.

17. A non-transitory computer-readable storage medium including a set of instructions for execution by a processor, the set of instructions, when executed, implement a controller configured to:

receive, via a network interface, a zone configuration from a first independent playback device of a plurality of independent playback devices, wherein the zone configuration is configured via the controller and maintained at the first independent playback device, and wherein the zone configuration characterizes one or more zone scenes, each zone scene identifying a group configuration associated with two or more of the plurality of independent playback devices; and

cause a selectable indication of the received zone configuration to be displayed, wherein the displayed selectable indication is selectable to cause one or more of the zone scenes to be invoked by two or more of the plurality of independent playback devices.

18. The computer-readable medium of claim **17**, wherein causing the selectable indication of the received zone configuration to be displayed comprises causing an indication of at least one of the one or more zone scenes to be displayed.

19. The computer readable medium of claim **17**, wherein causing the selectable indication of the at least one of the one or more zone scenes to be displayed comprises displaying an indication of the group configuration identified by the at least one of the one or more zone scenes to be displayed.

20. The computer readable medium of claim **19**, wherein the indication of the group configuration identified by the at least one of the one or more zone scenes comprises two or more groups of independent playback devices.

* * * * *

EXHIBIT 4

US010469966B2

(12) **United States Patent**
Lambourne

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(54) **ZONE SCENE MANAGEMENT**

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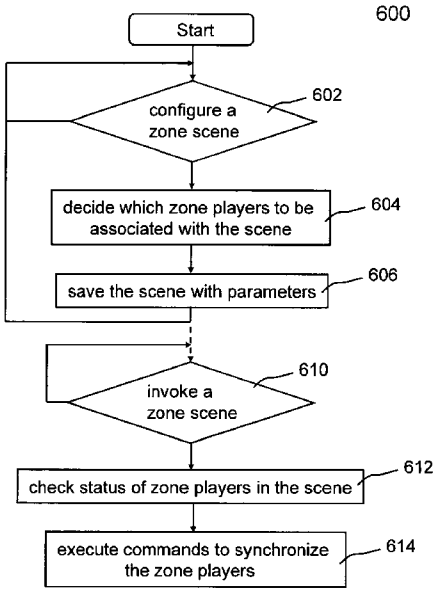
(57) **ABSTRACT**

An example computing device in a media playback system receives a first request to create a first zone scene including a first preconfigured grouping of zones including a first zone and a second zone, and based on the first request, causes creation and storage of the first zone scene. The computing device receives a second request to create a second zone scene including a second preconfigured grouping of zones including the first zone and a third zone, and based on the second request, causes creation and storage of the second zone scene. While displaying a representation of the first zone scene and a representation of the second zone scene, the computing devices receives a third request to invoke the first zone scene, and based on the third request, causes the first zone scene to be invoked such that the first zone and the second zone become configured for synchronous playback of media.

20 Claims, 13 Drawing Sheets



Related U.S. Application Data

No. 14/465,457, filed on Aug. 21, 2014, now Pat. No. 9,344,206, which is a continuation of application No. 13/896,829, filed on May 17, 2013, now Pat. No. 8,843,228, which is a continuation of application No. 11/853,790, filed on Sep. 11, 2007, now Pat. No. 8,483,853.

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CobraNet Manager, Direct control over your audio network. www.peakaudio.com/CobraNet/FAQ.html, 2005 [retrieved online Jul. 12, 2019 at web.archive.org/web/20050403214230/http://www.peakaudio.com/CobraNet/FAQ] 13 pages.
Non-Final Office Action dated Jul. 17, 2019, issued in connection with U.S. Appl. No. 15/130,919, filed Apr. 15, 2016, 15 pages.
Non-Final Office Action dated Aug. 28, 2019, issued in connection with U.S. Appl. No. 16/422,160, filed May 24, 2019, 14 pages.
Non-Final Office Action dated Jul. 5, 2019, issued in connection with U.S. Appl. No. 16/383,561, filed Apr. 12, 2019, 12 pages.

* cited by examiner

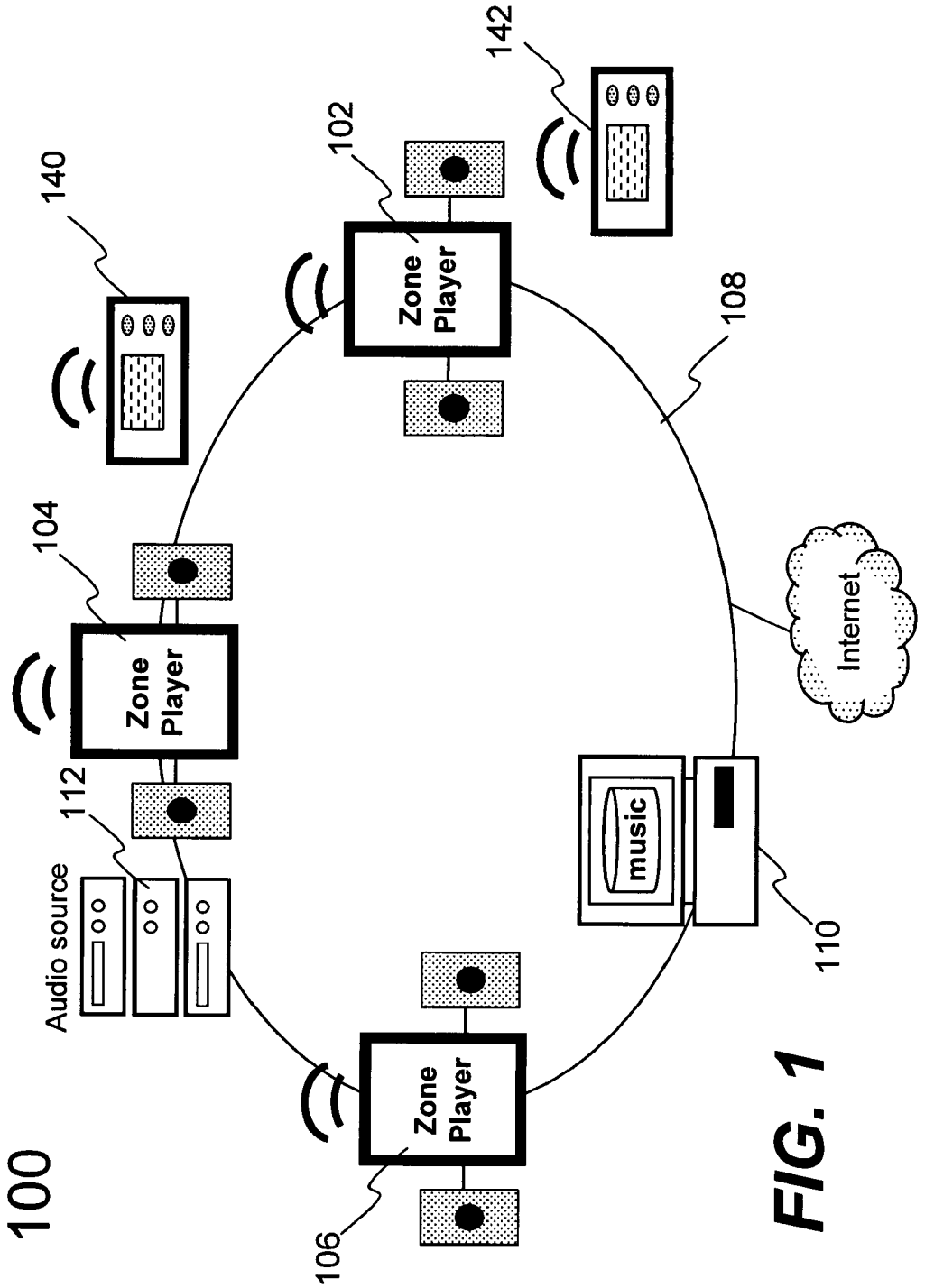

100
Zone Player
Zone Player
Zone Player
Audio source
music
Internet
102
104
106
108
110
112
140
142

FIG. 1

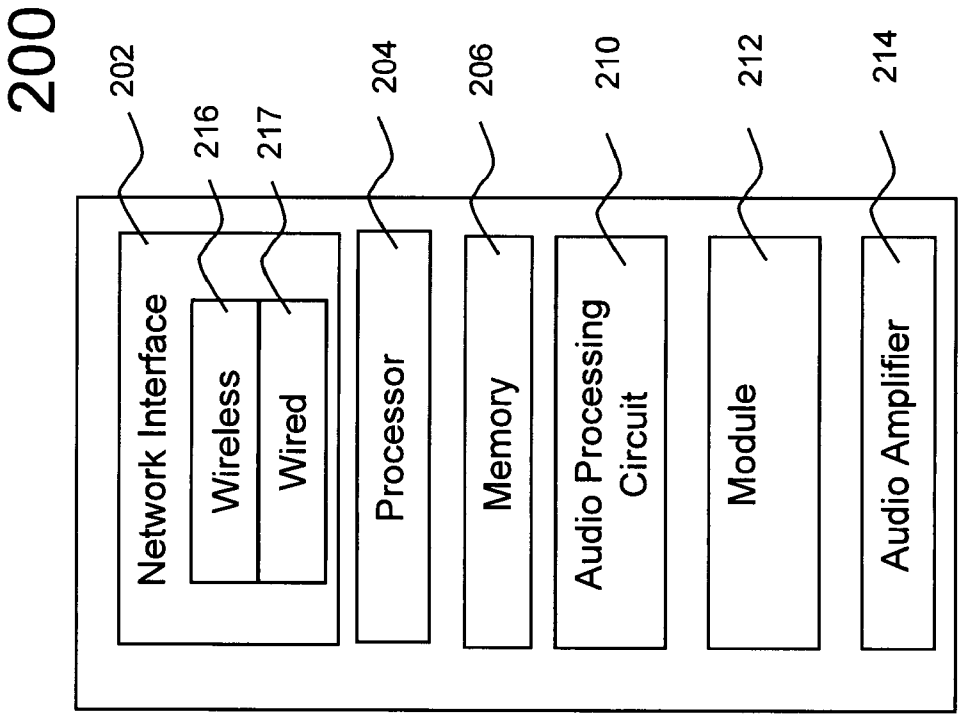

200
202
216
217
204
206
210
212
214
Network Interface
Wireless
Wired
Processor
Memory
Audio Processing Circuit
Module
Audio Amplifier

FIG. 2A

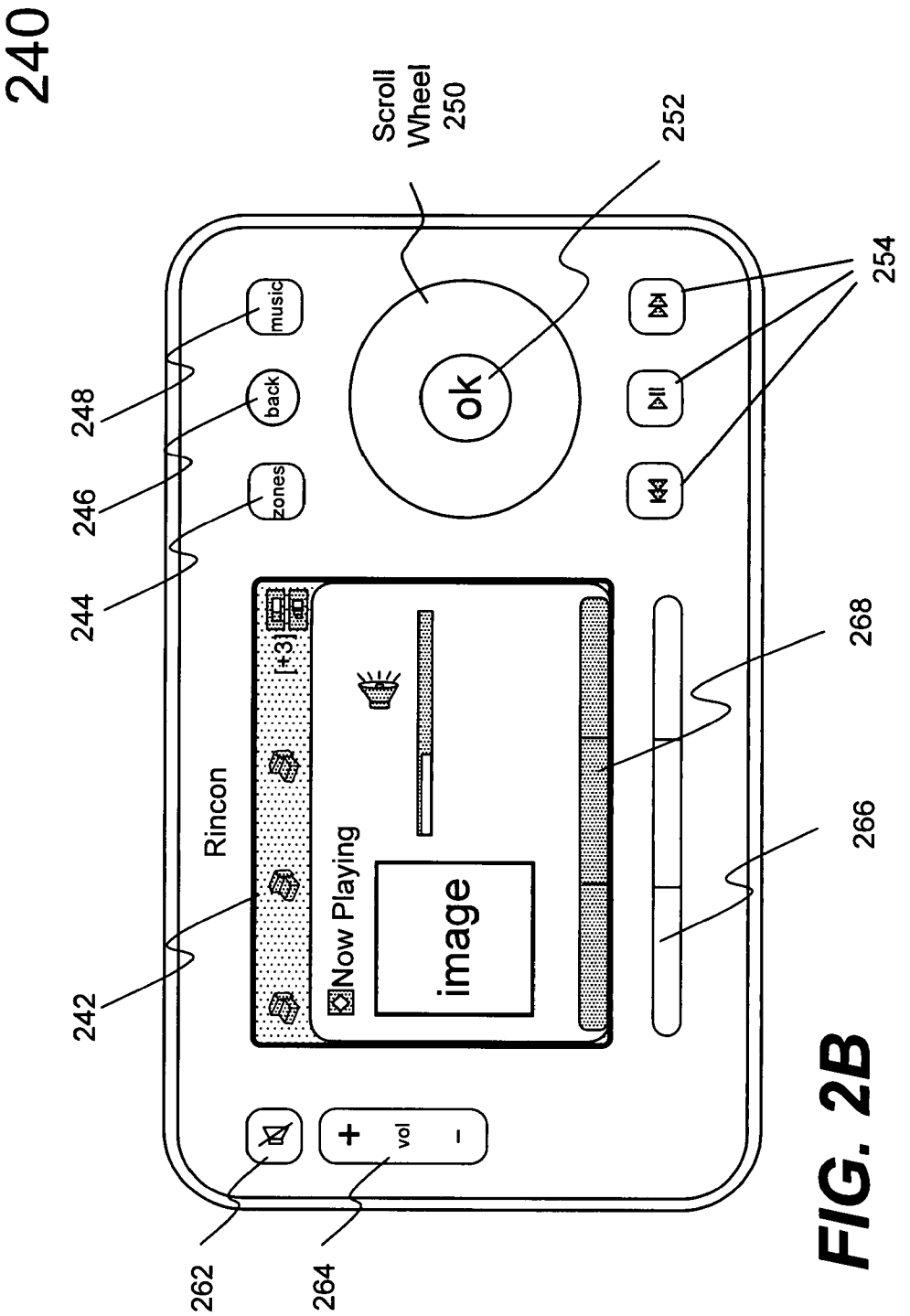

240
Scroll Wheel 250
252
254
248
246
244
242
268
266
262
264
music
back
zones
ok
Rincon
Now Playing
image
vol

FIG. 2B

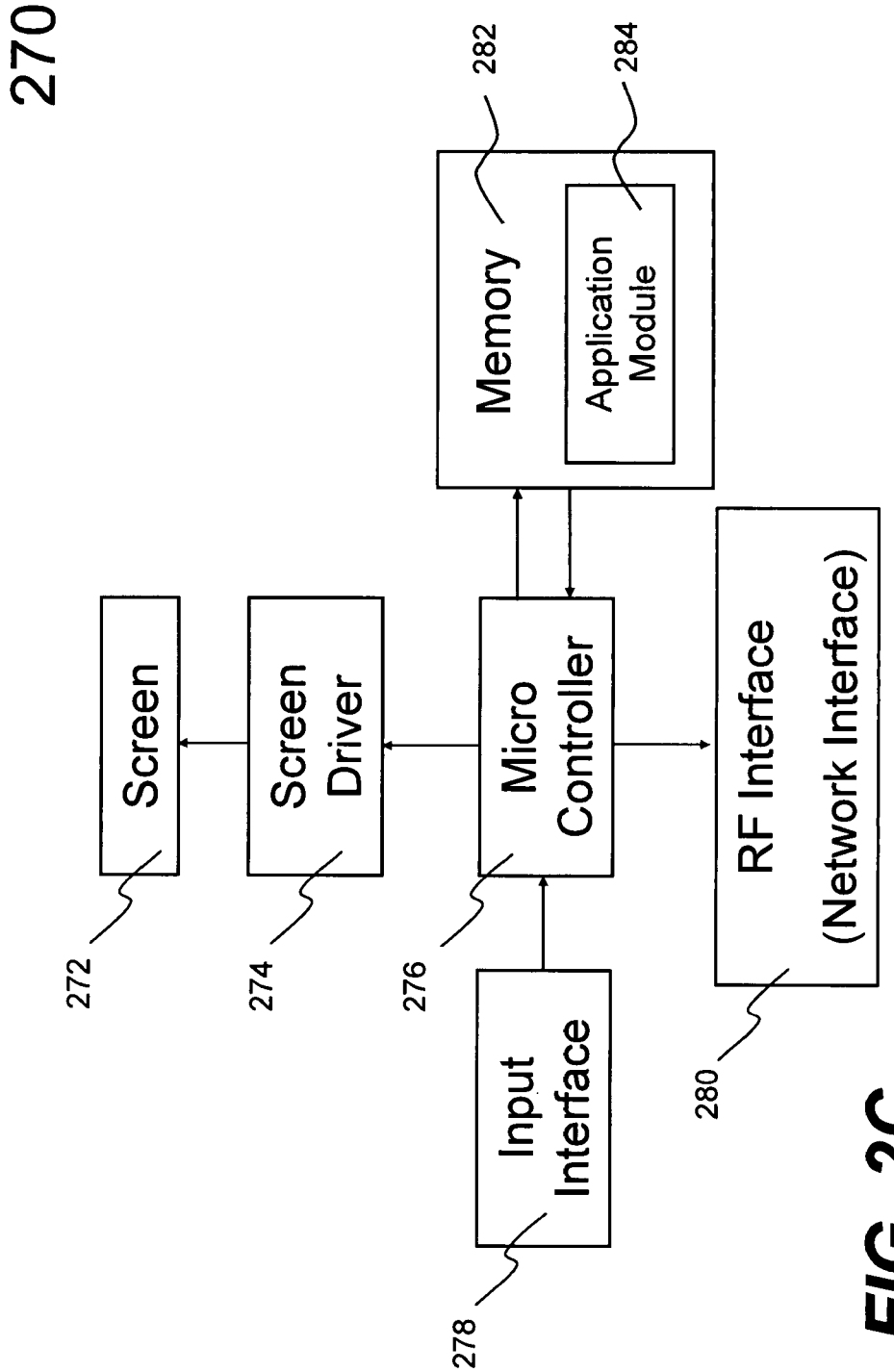

270
282
284
Memory
Application Module
Screen
Screen Driver
Micro Controller
RF Interface (Network Interface)
Input Interface
272
274
276
278
280

FIG. 2C

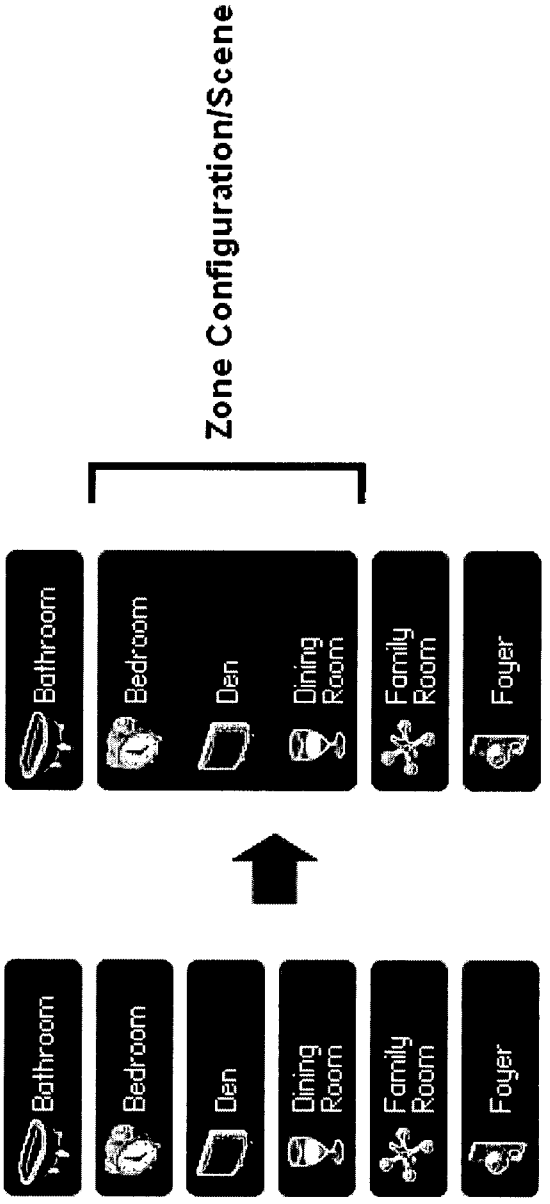
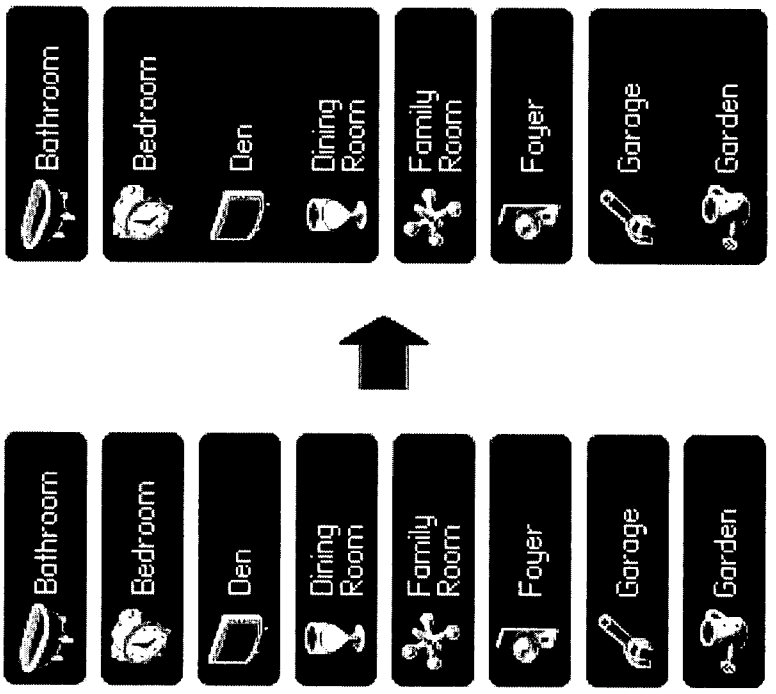

Zone Configuration/Scene
Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer
Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer

FIG. 3A

FIG. 3B


Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer
Garage
Garden
Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer
Garage
Garden

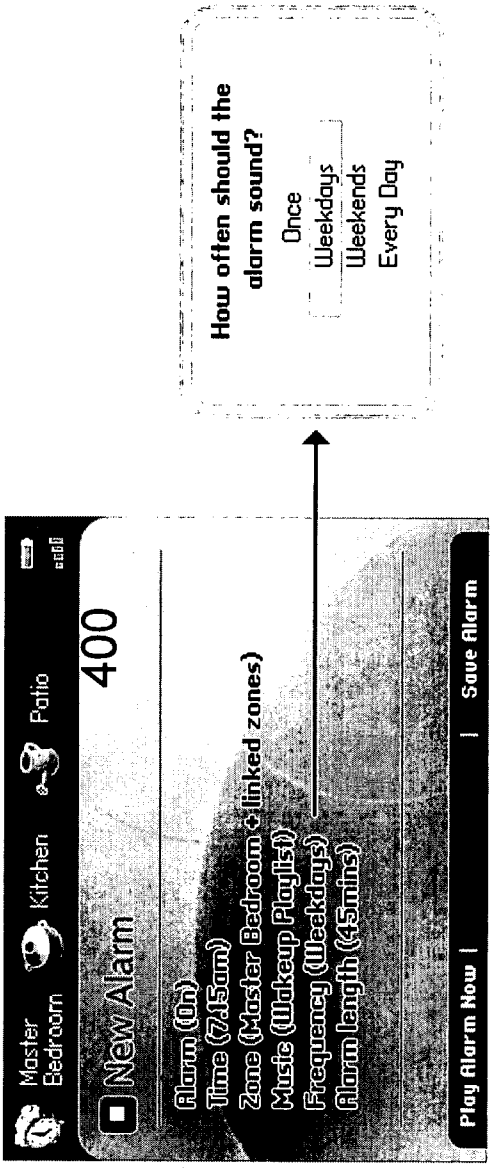

Master Bedroom
Kitchen
Patio
400
New Alarm
Alarm (On)
Time (7:45am)
Zone (Master Bedroom + linked zones)
Music (Wakeup Playlist)
Frequency (Weekdays)
Alarm length (45mins)
Play Alarm Now
Save Alarm
How often should the alarm sound?
Once
Weekdays
Weekends
Every Day

FIG. 4

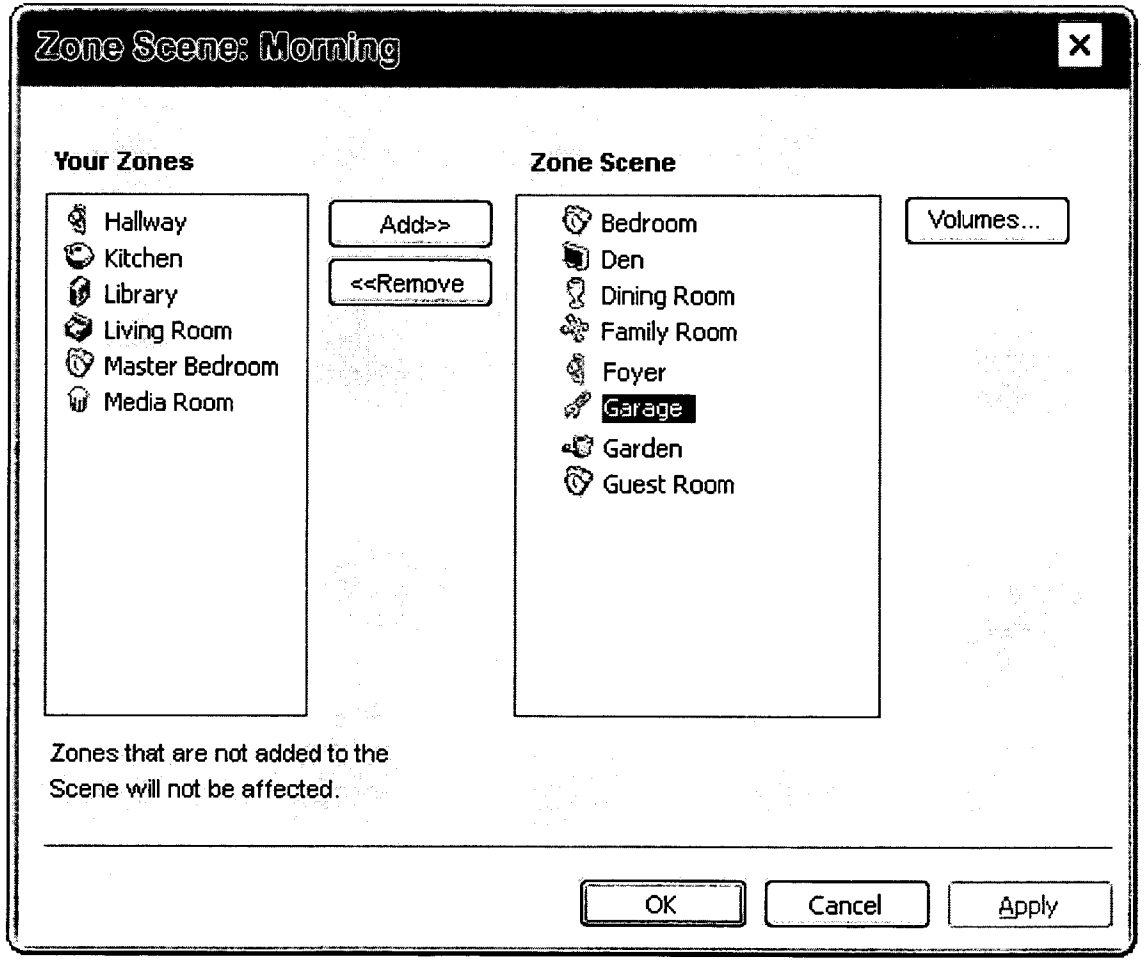

Zone Scene: Morning
500
Your Zones
Hallway
Kitchen
Library
Living Room
Master Bedroom
Media Room
Add>>
<<Remove
Zone Scene
Bedroom
Den
Dining Room
Family Room
Foyer
Garage
Garden
Guest Room
Volumes...
Zones that are not added to the Scene will not be affected.
OK
Cancel
Apply

FIG. 5A

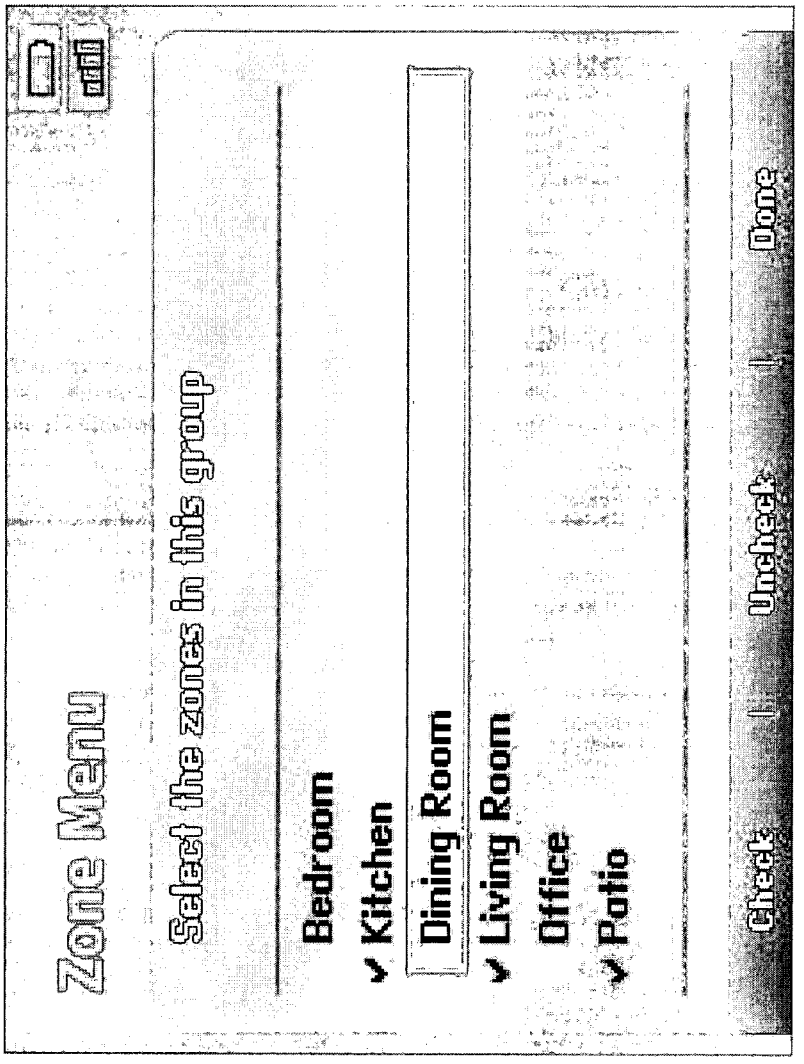

520
Zone Menu
Select the zones in this group
Bedroom
Kitchen
Dining Room
Living Room
Office
Patio
Check
Uncheck
Done

FIG. 5B

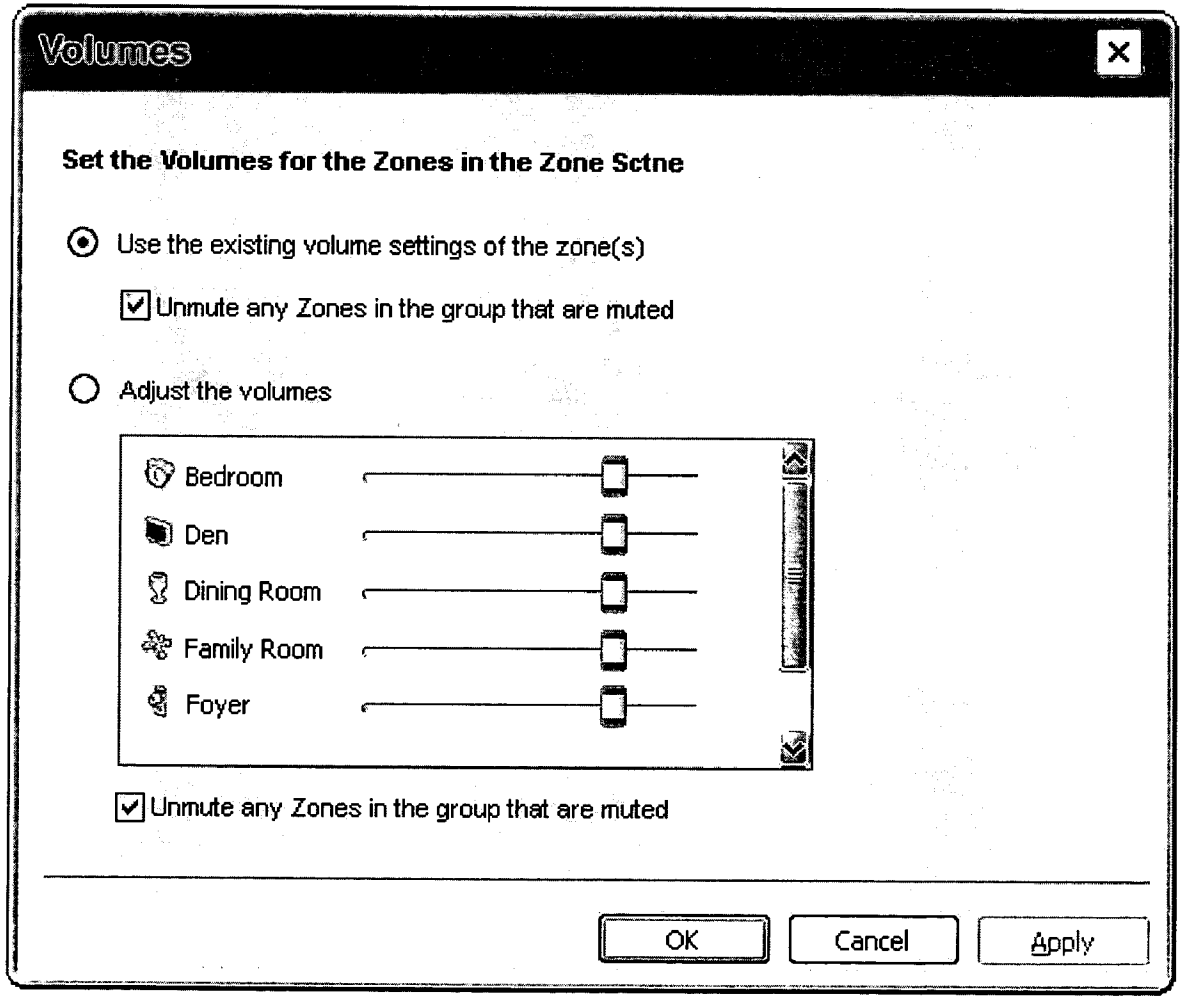

Volumes
510
Set the Volumes for the Zones in the Zone Sctne
Use the existing volume settings of the zone(s)
Unmute any Zones in the group that are muted
Adjust the volumes
Bedroom
Den
Dining Room
Family Room
Foyer
Unmute any Zones in the group that are muted
OK
Cancel
Apply

FIG. 5C

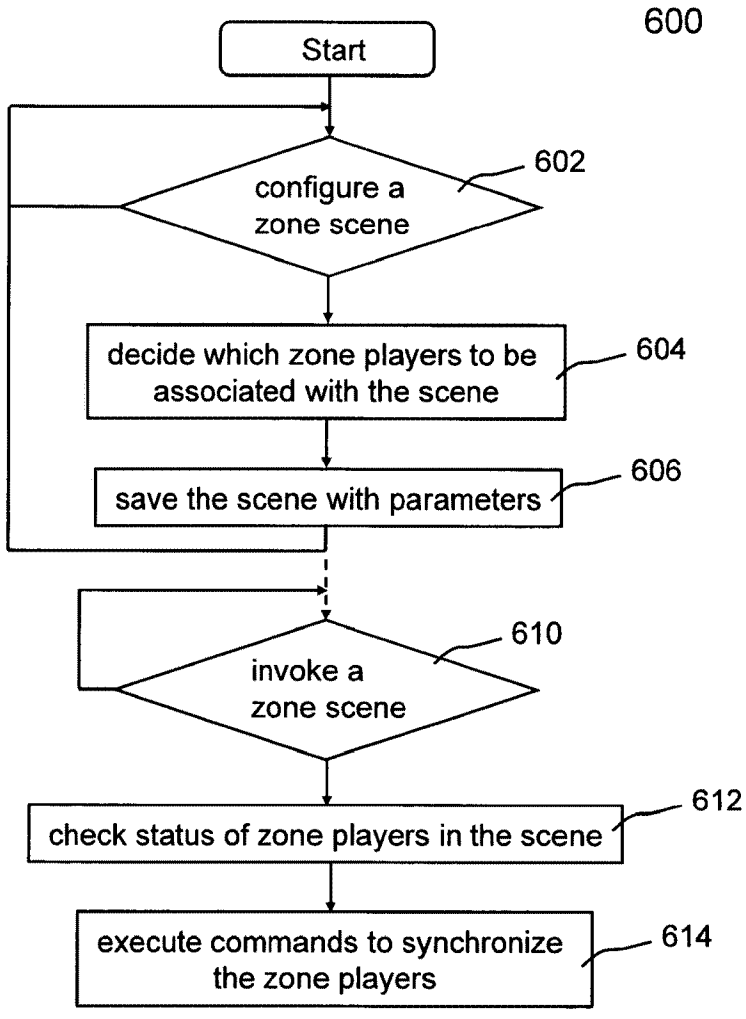

600
Start
configure a zone scene
602
decide which zone players to be associated with the scene
604
save the scene with parameters
606
invoke a zone scene
610
check status of zone players in the scene
612
execute commands to synchronize the zone players
614

FIG. 6

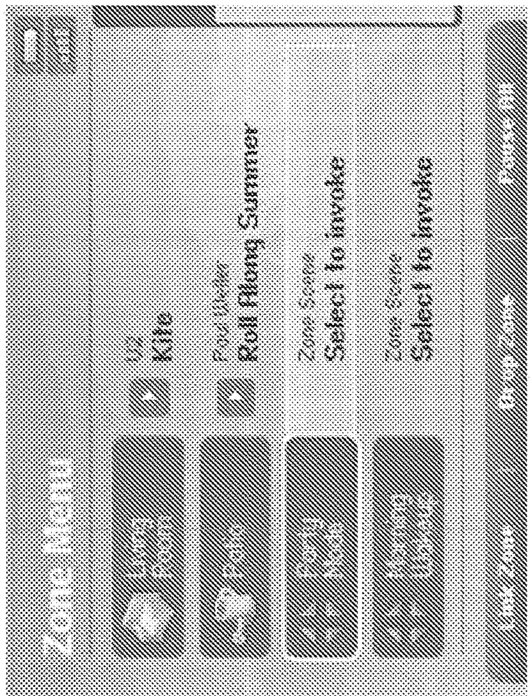

Zone Menu
U2
Kite
Roll Along Summer
Select to invoke
Select to invoke

FIG. 7

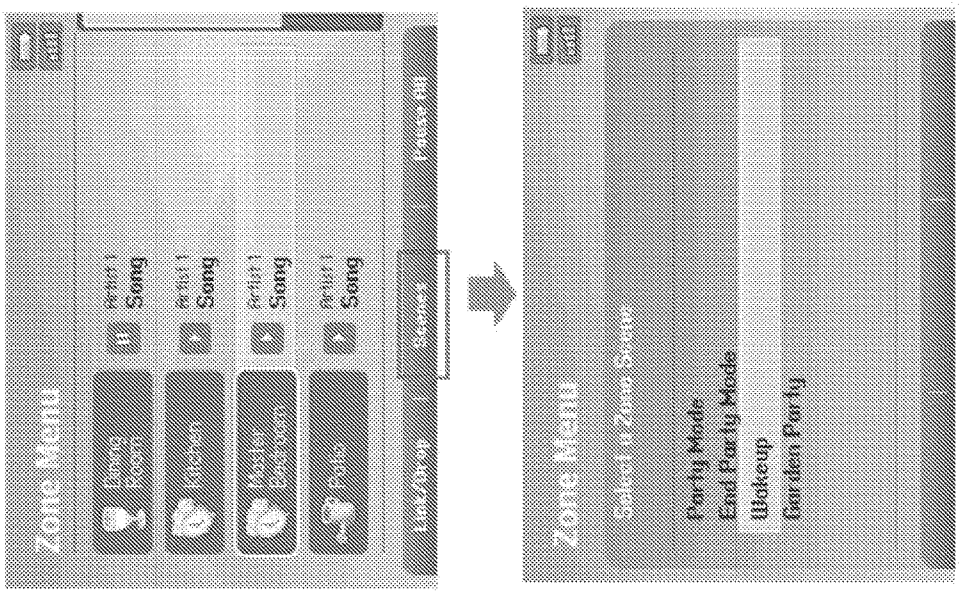

Zone Menu
Artist
Song
Artist
Song
Artist
Song
Artist
Song
Pause All
Zone Menu
Party Mode
End Party Mode
Wakeup
Garden Party

FIG. 8

ZONE SCENE MANAGEMENT

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of and claims priority to U.S. patent application Ser. No. 15/130,919, filed on Apr. 15, 2016, entitled "ZONE SCENE ACTIVATION," which is a continuation of U.S. patent application Ser. No. 14/465,457, filed on Aug. 21, 2014, entitled "METHOD AND APPARATUS FOR UPDATING ZONE CONFIGURATIONS IN A MULTI-ZONE SYSTEM," which is a continuation of U.S. patent application Ser. No. 13/896,829, filed on May 17, 2013, entitled "METHOD AND APPARATUS FOR UPDATING ZONE CONFIGURATIONS IN A MULTI-ZONE SYSTEM," which is a continuation of U.S. patent application Ser. No. 11/853,790, filed Sep. 11, 2007, entitled "CONTROLLING AND MANIPULATING GROUPINGS IN A MULTI-ZONE MEDIA SYSTEM," which claims priority to U.S. Provisional Application No. 60/825,407 filed on Sep. 12, 2006, entitled "CONTROLLING AND MANIPULATING GROUPINGS IN A MULTI-ZONE MEDIA SYSTEM," each of which is hereby incorporated by reference in its entirety for all purposes.

BACKGROUND OF THE INVENTION

Field of the Invention

The invention is generally related to the area of consumer electronics and human-computer interaction. In particular, the invention is related to method and apparatus for controlling or manipulating a plurality of multimedia players in a multi-zone system.

An enduring passion for quality audio reproduction or system is continuing to drive demands from users. One of the demands includes an audio system in a house in which, for example, one could grill to classic rock on a patio while another one may cook up his/her own music selections in a kitchen. This is all at the same time while a teenager catches a ballgame in a family room, and another one blasts pop in a bedroom. And the best part of such audio system is that each family member does not need his or her own stereo system—one system gives everyone access to all the music sources.

Currently, one of the systems that can meet part of such demand is a conventional multi-zone audio system that usually includes a number of audio players. Each of the audio players has its own amplifier(s) and a set of speakers and typically installed in one place (e.g., a room). In order to play an audio source at one location, the audio source must be provided locally or from a centralized location. When the audio source is provided locally, the multi-zone audio system functions as a collection of many stereo systems, making source sharing difficult. When the audio source is provided centrally, the centralized location may include a juke box, many compact discs, an AM or FM radio, tapes, or others. To send an audio source to an audio player demanding such source, a cross-bar type of device is used to prevent the audio source from going to other audio players that may be playing other audio sources.

In order to achieve playing different audio sources in different audio players, the traditional multi-zone audio system is generally either hard-wired or controlled by a pre-configured and pre-programmed controller. While the pre-programmed configuration may be satisfactory in one situation, it may not be suitable for another situation. For

example, a person would like to listen to broadcast news from his/her favorite radio station in a bedroom, a bathroom and a den while preparing to go to work in the morning. The same person may wish to listen in the den and the living room to music from a compact disc in the evening. In order to satisfy such requirements, two groups of audio players must be established. In the morning, the audio players in the bedroom, the bathroom and the den need to be grouped for the broadcast news. In the evening, the audio players in the den and the living room are grouped for the music. Over the weekend, the audio players in the den, the living room, and a kitchen are grouped for party music. Because the morning group, the evening group and the weekend group contain the den, it can be difficult for the traditional system to accommodate the requirement of dynamically managing the ad hoc creation and deletion of groups.

There is a need for dynamic control of the audio players as a group. With a minimum manipulation, the audio players may be readily grouped. In a traditional multi-zone audio system, the audio players have to be adjusted one at a time, resulting in an inconvenient and non-homogenous audio environment. Further, there is a need to individually or systematically adjust the audio volume of the audio players.

SUMMARY OF THE INVENTION

This section is for the purpose of summarizing some aspects of the present invention and to briefly introduce some preferred embodiments. Simplifications or omissions in this section as well as in the abstract or the title of this description may be made to avoid obscuring the purpose of this section, the abstract and the title. Such simplifications or omissions are not intended to limit the scope of the present invention.

In general, the present invention pertains to controlling a plurality of multimedia players, or simply players, in groups. According to one aspect of the present invention, a mechanism is provided to allow a user to group some of the players according to a theme or scene, where each of the players is located in a zone. When the scene is activated, the players in the scene react in a synchronized manner. For example, the players in the scene are all caused to play an audio source or music in a playlist, wherein the audio source may be located anywhere on a network.

According to another aspect of the present invention, the scene may be activated at any time or a specific time. A user may activate the scene at any time so that only some selected zones in an entertainment system facilitate a playback of an audio source. When the scene is activated at a specific time, the scene may be used as an alarm or buzzer.

According to still another aspect of the present invention, a controlling device (also referred to herein as controller) is provided to facilitate a user to select any of the players in the system to form respective groups each of which is set up per a scene. Although various scenes may be saved in any of the members in a group, commands are preferably sent from the controller to the rest of the members when one of the scenes is executed. Depending on implementation, the commands include parameters pertaining to identifiers of the players, volumes settings, audio source and etc.

According to yet another aspect of the present invention, a configurable module is implemented in the controlling device that provides interactive graphic user interface for forming, managing and controlling groups in the system, de-grouping a group or adjusting audio volume of individual players or a group of players.

The present invention may be implemented in many forms including software, hardware or a combination of both. According to one embodiment, the present invention is directed to a method for groupings in a multi-zone media system, the method comprises providing a mechanism to allow a user to determine which players in the system to be associated with a theme representing a group; and configuring the theme with parameters pertaining to the players, wherein the theme is activated at anytime or a specific time so that the players react in a synchronized manner. The players in a scene are synchronized to play a multimedia file when the scene is activated.

According to another embodiment, the present invention is directed to an entertainment system for grouping players, the system comprises: a plurality of players, each located in one zone; and a controller providing a mechanism to allow a user to select which of the players to be associated with a theme representing a group; and configure the theme with parameters pertaining to the selected players, wherein the theme is activated at anytime or a specific time so that the selected players react in a synchronized manner. As a result, the selected players are synchronized to play a multimedia that is in a digital format and retrieved from a source over a network.

One of the objects, features, and advantages of the present invention is to remotely control a plurality of multimedia players in a multi-zone system, playing and controlling the audio source synchronously if the players are grouped together, or playing and controlling the audio source individually if the players are disassociated with each other.

Other objects, features, and advantages of the present invention will become apparent upon examining the following detailed description of an embodiment thereof, taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. **1** shows an exemplary configuration in which the present invention may be practiced;

FIG. **2**A shows an exemplary functional block diagram of a player in accordance with the present invention;

FIG. **2**B shows an example of a controller that may be used to remotely control one of more players of FIG. **2**A;

FIG. **2**C shows an exemplary internal functional block diagram of a controller in accordance with one embodiment of the present invention;

FIG. **3**A provides an illustration of one zone scene, where the left column shows the starting zone grouping—all zones are separate, the column on the right shows the effects of grouping the zones to make a group of 3 zones named after "Morning";

FIG. **3**B shows that a user defines multiple groups to be gathered at the same time;

FIG. **4** shows an exemplary user interface that may be displayed on a controller or a computer of FIG. **1**;

FIG. **5**A shows a user interface to allow a user to form a scene;

FIG. **5**B shows another user interface **520** to allow a user to form a scene;

FIG. **5**C shows a user interface to allow a user to adjust a volume level of the zone players in a zone scene individually or collectively;

FIG. **6** shows a flowchart or process of providing a player theme or a zone scene for a plurality of players, where one or more of the players are placed in a zone; and

FIG. **7** shows an example user interface for invoking a zone scene; and

FIG. **8** shows another example user interface for invoking a zone scene.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The detailed description of the invention is presented largely in terms of procedures in terms of procedures, steps, logic blocks, processing, and other symbolic representations that directly or indirectly resemble the operations of data processing devices coupled to networks. These process descriptions and representations are typically used by those skilled in the art to most effectively convey the substance of their work to others skilled in the art. Numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will become obvious to those skilled in the art that the present invention may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuitry have not been described in detail to avoid unnecessarily obscuring aspects of the present invention.

Reference herein to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Further, the order of blocks in process flowcharts or diagrams representing one or more embodiments of the invention do not inherently indicate any particular order nor imply any limitations in the invention.

Referring now to the drawings, in which like numerals refer to like parts throughout the several views. FIG. **1** shows an exemplary configuration **100** in which the present invention may be practiced. The configuration may represent, but not be limited to, a part of a residential home, a business building or a complex with multiple zones. There are a number of multimedia players of which three examples **102**, **104** and **106** are shown as audio devices. Each of the audio devices may be installed or provided in one particular area or zone and hence referred to as a zone player herein.

As used herein, unless explicitly stated otherwise, an audio source or audio sources are in digital format and can be transported or streamed over a data network. To facilitate the understanding of the present invention, it is assumed that the configuration **100** represents a home. Thus, the zone player **102** and **104** may be located in two of the bedrooms respectively while the zone player **106** may be installed in a living room. All of the zone players **102**, **104** and **106** are coupled directly or indirectly to a data network **108**. In addition, a computing device **110** is shown to be coupled on the network **108**. In reality, any other devices such as a home gateway device, a storage device, or an MP3 player may be coupled to the network **108** as well.

The network **108** may be a wired network, a wireless network or a combination of both. In one example, all devices including the zone players **102**, **104** and **106** are coupled to the network **108** by wireless means based on an industry standard such as IEEE 802.11. In yet another example, all devices including the zone players **102**, **104** and

106 are part of a local area network that communicates with a wide area network (e.g., the Internet).

Many devices on the network **108** are configured to download and store audio sources. For example, the computing device **110** can download audio sources from the Internet and store the downloaded sources locally for sharing with other devices on the Internet or the network **108**. The computing device **110** or any of the zone players can also be configured to receive streaming audio. Shown as a stereo system, the device **112** is configured to receive an analog audio source (e.g., from broadcasting) or retrieve a digital audio source (e.g., from a compact disk). The analog audio sources can be converted to digital audio sources. In accordance with the present invention, the audio source may be shared among the devices on the network **108**.

Two or more zone players may be grouped together to form a new zone group. Any combinations of zone players and an existing zone group may be grouped together. In one instance, a new zone group is formed by adding one zone player to another zone player or an existing zone group.

Referring now to FIG. **2**A, there is shown an exemplary functional block diagram of a zone player **200** in accordance with the present invention. The zone player **200** includes a network interface **202**, a processor **204**, a memory **206**, an audio processing circuit **210**, a module **212**, and optionally, an audio amplifier **214** that may be internal or external. The network interface **202** facilitates a data flow between a data network (i.e., the data network **108** of FIG. **1**) and the zone player **200** and typically executes a special set of rules (i.e., a protocol) to send data back and forth. One of the common protocols used in the Internet is TCP/IP (Transmission Control Protocol/Internet Protocol). In general, a network interface manages the assembling of an audio source or file into smaller packets that are transmitted over the data network or reassembles received packets into the original source or file. In addition, the network interface **202** handles the address part of each packet so that it gets to the right destination or intercepts packets destined for the zone player **200**.

The network interface **202** may include one or both of a wireless interface **216** and a wired interface **217**. The wireless interface **216**, also referred to as a RF interface, provides network interface functions by a wireless means for the zone player **200** to communicate with other devices in accordance with a communication protocol (such as the wireless standard IEEE 802.11a, 802.11b or 802.11g). The wired interface **217** provides network interface functions by a wired means (e.g., an Ethernet cable). In one embodiment, a zone player includes both of the interfaces **216** and **217**, and other zone players include only a RF or wired interface. Thus these other zone players communicate with other devices on a network or retrieve audio sources via the zone player. The processor **204** is configured to control the operation of other parts in the zone player **200**. The memory **206** may be loaded with one or more software modules that can be executed by the processor **204** to achieve desired tasks. According to one aspect of the present invention, a software module implementing one embodiment of the present invention is executed, the processor **204** operates in accordance with the software module in reference to a saved zone group configuration characterizing a zone group created by a user, the zone player **200** is caused to retrieve an audio source from another zone player or a device on the network.

According to one embodiment of the present invention, the memory **206** is used to save one or more saved zone configuration files that may be retrieved for modification at any time. Typically, a saved zone group configuration file is transmitted to a controller (e.g., the controlling device **140** or **142** of FIG. **1**, a computer, a portable device, or a TV) when a user operates the controlling device. The zone group configuration provides an interactive user interface so that various manipulations or control of the zone players may be performed.

The audio processing circuit **210** resembles most of the circuitry in an audio playback device and includes one or more digital-to-analog converters (DAC), an audio preprocessing part, an audio enhancement part or a digital signal processor and others. In operation, when an audio source is retrieved via the network interface **202**, the audio source is processed in the audio processing circuit **210** to produce analog audio signals. The processed analog audio signals are then provided to the audio amplifier **214** for playback on speakers. In addition, the audio processing circuit **210** may include necessary circuitry to process analog signals as inputs to produce digital signals for sharing with other devices on a network.

Depending on an exact implementation, the module **212** may be implemented as a combination of hardware and software. In one embodiment, the module **212** is used to save a scene. The audio amplifier **214** is typically an analog circuit that powers the provided analog audio signals to drive one or more speakers.

Referring now to FIG. **2**B, there is shown an exemplary controller **240**, which may correspond to the controlling device **140** or **142** of FIG. **1**. The controller **240** may be used to facilitate the control of multi-media applications, automation and others in a complex. In particular, the controller **240** is configured to facilitate a selection of a plurality of audio sources available on the network, controlling operations of one or more zone players (e.g., the zone player **200**) through a RF interface corresponding to the RF interface **216** of FIG. **2**A. According to one embodiment, the wireless means is based on an industry standard (e.g., infrared, radio, wireless standard IEEE 802.11a, 802.11b or 802.11g). When a particular audio source is being played in the zone player **200**, a picture, if there is any, associated with the audio source may be transmitted from the zone player **200** to the controller **240** for display. In one embodiment, the controller **240** is used to synchronize more than one zone players by grouping the zone players in a group. In another embodiment, the controller **240** is used to control the volume of each of the zone players in a zone group individually or together.

The user interface for the controller **240** includes a screen **242** (e.g., a LCD screen) and a set of functional buttons as follows: a "zones" button **244**, a "back" button **246**, a "music" button **248**, a scroll wheel **250**, "ok" button **252**, a set of transport control buttons **254**, a mute button **262**, a volume up/down button **264**, a set of soft buttons **266** corresponding to the labels **268** displayed on the screen **242**.

The screen **242** displays various screen menus in response to a user's selection. In one embodiment, the "zones" button **244** activates a zone management screen or "Zone Menu", which is described in more details below. The "back" button **246** may lead to different actions depending on the current screen. In one embodiment, the "back" button triggers the current screen display to go back to a previous one. In another embodiment, the 'back" button negates the user's erroneous selection. The "music" button **248** activates a music menu, which allows the selection of an audio source (e.g., a song) to be added to a zone player's music queue for playback.

The scroll wheel **250** is used for selecting an item within a list, whenever a list is presented on the screen **242**. When the items in the list are too many to be accommodated in one screen display, a scroll indicator such as a scroll bar or a scroll arrow is displayed beside the list. When the scroll indicator is displayed, a user may rotate the scroll wheel **250** to either choose a displayed item or display a hidden item in the list. The "ok" button **252** is used to confirm the user selection on the screen **242**.

There are three transport buttons **254**, which are used to control the effect of the currently playing song. For example, the functions of the transport buttons may include play/pause and forward/rewind a song, move forward to a next song track, or move backward to a previous track. According to one embodiment, pressing one of the volume control buttons such as the mute button **262** or the volume up/down button **264** activates a volume panel. In addition, there are three soft buttons **266** that can be activated in accordance with the labels **268** on the screen **242**. It can be understood that, in a multi-zone system, there may be multiple audio sources being played respectively in more than one zone players. The music transport functions described herein shall apply selectively to one of the sources when a corresponding one of the zone players or zone groups is selected.

FIG. **2**C illustrates an internal functional block diagram of an exemplary controller **270**, which may correspond to the controller **240** of FIG. **2**B. The screen **272** on the controller **270** may be a LCD screen. The screen **272** communicates with and is commanded by a screen driver **274** that is controlled by a microcontroller (e.g., a processor) **276**. The memory **282** may be loaded with one or more application modules **284** that can be executed by the microcontroller **276** with or without a user input via the user interface **278** to achieve desired tasks. In one embodiment, an application module is configured to facilitate grouping a number of selected zone players into a zone group and synchronizing the zone players for one audio source. In another embodiment, an application module is configured to control together the audio volumes of the zone players in a zone group. In operation, when the microcontroller **276** executes one of the application modules **284**, the screen driver **274** generates control signals to drive the screen **272** to display an application specific user interface accordingly, more of which will be described below.

The controller **270** includes a network interface **280** referred to as a RF interface **280** that facilitates wireless communication with a zone player via a corresponding RF interface thereof. In one embodiment, the commands such as volume control and audio playback synchronization are sent via the RF interfaces. In another embodiment, a saved zone group configuration is transmitted between a zone player and a controller via the RF interfaces. The controller **270** may control one or more zone players, such as **102**, **104** and **106** of FIG. **1**. Nevertheless, there may be more than one controllers, each preferably in a zone (e.g., a room) and configured to control any one and all of the zone players.

In one embodiment, a user creates a zone group including at least two zone players from the controller **240** that sends signals or data to one of the zone players. As all the zone players are coupled on a network, the received signals in one zone player can cause other zone players in the group to be synchronized so that all the zone players in the group playback an identical audio source or a list of identical audio sources in a timely synchronized manner. Similarly, when a user increases the audio volume of the group from the controller, the signals or data of increasing the audio volume for the group are sent to one of the zone players and causes other zone players in the group to be increased together in volume and in scale.

According to one implementation, an application module is loaded in memory **282** for zone group management. When a predetermined key (e.g. the "zones" button **244**) is activated on the controller **240**, the application module is executed in the microcontroller **276**. The input interface **278** coupled to and controlled by the microcontroller **276** receives inputs from a user. A "Zone Menu" is then displayed on the screen **272**. The user may start grouping zone players into a zone group by activating a "Link Zones" or "Add Zone" soft button, or de-grouping a zone group by activating an "Unlink Zones" or "Drop Zone" button. The detail of the zone group manipulation will be further discussed below.

As described above, the input interface **278** includes a number of function buttons as well as a screen graphical user interface. It should be pointed out that the controller **240** in FIG. **2**B is not the only controlling device that may practice the present invention. Other devices that provide the equivalent control functions (e.g., a computing device, a hand-held device) may also be configured to practice the present invention. In the above description, unless otherwise specifically described, it is clear that keys or buttons are generally referred to as either the physical buttons or soft buttons, enabling a user to enter a command or data.

One mechanism for 'joining' zone players together for music playback is to link a number of zone players together to form a group. To link a number of zone players together, a user may manually link each zone player or room one after the other. For example, there is a multi-zone system that includes the following zones.

Bathroom
Bedroom
Den
Dining Room
Family Room
Foyer

If the user wishes to link **5** of the **6** zone players using the current mechanism, he/she must start with a single zone and then manually link each zone to that zone. This mechanism may be sometimes quite time consuming. According to one embodiment, a set of zones can be dynamically linked together using one command. Using what is referred to herein as a theme or a zone scene, zones can be configured in a particular scene (e.g., morning, afternoon, or garden), where a predefined zone grouping and setting of attributes for the grouping are automatically effectuated.

For instance, a "Morning" zone scene/configuration command would link the Bedroom, Den and Dining Room together in one action. Without this single command, the user would need to manually and individually link each zone. FIG. **3**A provides an illustration of one zone scene, where the left column shows the starting zone grouping—all zones are separate, the column on the right shows the effects of grouping the zones to make a group of 3 zones named after "Morning".

Expanding this idea further, a Zone Scene can be set to create multiple sets of linked zones. For example, a scene creates **3** separate groups of zones, the downstairs zones would be linked together, the upstairs zones would be linked together in their own group, and the outside zones (in this case the patio) would move into a group of its own.

In one embodiment as shown in FIG. **3**B, a user defines multiple groups to be gathered at the same time. For example: an "Evening Scene" is desired to link the following zones:

Group 1
Bedroom
Den
Dining Room
Group 2
Garage
Garden

where Bathroom, Family Room and Foyer should be separated from any group if they were part of a group before the Zone Scene was invoked.

One important of the features, benefits and objects in the present invention is that zones do not need to be separated before a zone scene is invoked. In one embodiment, a command is provided and links all zones in one step, if invoked. The command is in a form of a zone scene. After linking the appropriate zones, a zone scene command could apply the following attributes:

Set volumes levels in each zones (each zone can have a different volume)

Mute/Unmute zones.

Select and play specific music in the zones.

Set the play mode of the music (Shuffle, Repeat, Shuffle-repeat)

Set the music playback equalization of each zone (e.g., bass treble).

A further extension of this embodiment is to trigger a zone scene command as an alarm clock function. For instance the zone scene is set to apply at 8:00 am. It could link appropriate zones automatically, set specific music to play and then stop the music after a defined duration. Although a single zone may be assigned to an alarm, a scene set as an alarm clock provides a synchronized alarm, allowing any zones linked in the scene to play a predefined audio (e.g., a favorable song, a predefined playlist) at a specific time or for a specific duration. If, for any reason, the scheduled music failed to be played (e.g., an empty playlist, no connection to a share, failed UPnP, no Internet connection for an Internet Radio station), a backup buzzer will sound. This buzzer will be a sound file that is stored in a zone player.

FIG. **4** shows an exemplary user interface **400** that may be displayed on a controller **142** or a computer **110** of FIG. **1**. The interface **400** shows a list of items that may be set up by a user to cause a scene to function at a specific time. In the embodiment shown in FIG. **4**, the list of items includes "Alarm", "Time", "Zone", "Music", "Frequency" and "Alarm length". "Alarm" can be set on or off. When "Alarm" is set on, "Time" is a specific time to set off the alarm. "Zone" shows which zone players are being set to play a specified audio at the specific time. "Music" shows what to be played when the specific time arrives. "Frequency" allows the user to define a frequency of the alarm. "Alarm length" defines how long the audio is to be played. It should be noted that the user interface **400** is provided herein to show some of the functions associated with setting up an alarm. Depending on an exact implementation, other functions, such as time zone, daylight savings, time synchronization, and time/date format for display may also be provided without departing from the present invention.

According to one embodiment, each zone player in a scene may be set up for different alarms. For example, a "Morning" scene includes three zone players, each in a bedroom, a den, and a dining room. After selecting the scene, the user may set up an alarm for the scene as whole. As a result, each of the zone players will be activated at a specific time.

FIG. **5**A shows a user interface **500** to allow a user to form a scene. The panel on the left shows the available zones in a household. The panel on the right shows the zones that have been selected and be grouped as part of this scene. Depending on an exact implementation of a user interface, Add/Remove buttons may be provided to move zones between the panels, or zones may be dragged along between panels.

FIG. **5**B shows another user interface **520** to allow a user to form a scene. The user interface **520** that may be displayed on a controller or a computing device, lists available zones in a system. The list of zones in the user interface **520** includes ALL the zones in the system, including the zones that are already grouped. A checkbox is provide next to each of the zones so that a user may check in the zones to be associated with the scene.

FIG. **5**C shows a user interface **510** to allow a user to adjust a volume level of the zone players in a zone scene individually or collectively. As shown in the user interface **510**, the 'Volumes . . . ' button (shown as sliders, other forms are possible) allows the user to affect the volumes of the associated zone players when a zone scene is invoked. In one embodiment, the zone players can be set to retain whatever volume that they currently have when the scene is invoked. Additionally the user can decide if the volumes should be unmuted or muted when the scene is invoked.

FIG. **6** shows a flowchart or process **600** of providing a player theme or a zone scene for a plurality of players, where one or more of the players are placed in a zone. The process **600** is presented in accordance with one embodiment of the present invention and may be implemented in a module to be located in the memory **282** of FIG. **2**C.

The process **600** is initiated only when a user decides to proceed with a zone scene at **602**. The process **600** then moves to **604** where it allows a user to decide which zone players to be associated with the scene. For example, there are ten players in a household, and the scene is named after "Morning". The user may be given an interface to select four of the ten players to be associated with the scene. At **606**, the scene is saved. The scene may be saved in any one of the members in the scene. In the example of FIG. **1**, the scene is saved in one of the zone players and displayed on the controller **142**. In operation, a set of data pertaining to the scene includes a plurality of parameters. In one embodiment, the parameters include, but may not be limited to, identifiers (e.g., IP address) of the associated players and a playlist. The parameters may also include volume/tone settings for the associated players in the scene. The user may go back to **602** to configure another scene if desired.

Given a saved scene, a user may activate the scene at any time or set up a timer to activate the scene at **610**. The process **600** can continue when a saved scene is activated at **610**. At **612**, upon the activation of a saved scene, the process **600** checks the status of the players associated with the scene. The status of the players means that each of the players shall be in condition to react in a synchronized manner. In one embodiment, the interconnections of the players are checked to make sure that the players communicate among themselves and/or with a controller if there is such a controller in the scene.

It is assumed that all players associated with the scene are in good condition. At **614**, commands are executed with the parameters (e.g., pertaining to a playlist and volumes). In one embodiment, data including the parameters is trans-

ported from a member (e.g., a controller) to other members in the scene so that the players are caused to synchronize an operation configured in the scene. The operation may cause all players to play back a song in identical or different volumes or to play back a pre-stored file.

One of the features, benefits and advantages in the present invention is to allow sets of related devices (controllers and operating components) to exist as a group without interfering with other components that are potentially visible on the same wired or wireless network. Each of the sets is configured to a theme or a scene.

FIG. **7** shows an example user interface for invoking a zone scene. The user interface of FIG. **7** shows a Zone Menu that includes selectable indications of zone scenes.

FIG. **8** shows another example user interface for invoking a zone scene. FIG. **8** shows a Zone Menu that includes a softkey indicating a Scenes menu. Pressing the Scenes softkey will show the Scenes menu where all the available zone scenes are shown as selectable indications.

The present invention has been described in sufficient detail with a certain degree of particularity. It is understood to those skilled in the art that the present disclosure of embodiments has been made by way of examples only and that numerous changes in the arrangement and combination of parts may be resorted without departing from the spirit and scope of the invention as claimed. While the embodiments discussed herein may appear to include some limitations as to the presentation of the information units, in terms of the format and arrangement, the invention has applicability well beyond such embodiment, which can be appreciated by those skilled in the art. Accordingly, the scope of the present invention is defined by the appended claims rather than the forgoing description of embodiments.

I claim:

1. A computing device comprising: one or more processors;

a non-transitory computer-readable medium; and program instructions stored on the non-transitory computer-readable medium that, when executed by the one or more processors, cause the computing device to perform functions comprising:

while serving as a controller for a networked media playback system comprising a first zone player and at least two other zone players, wherein the first zone player is operating in a standalone mode in which the first zone player is configured to play back media individually:

receiving a first request to create a first zone scene comprising a first predefined grouping of zone players including at least the first zone player and a second zone player that are to be configured for synchronous playback of media when the first zone scene is invoked;

based on the first request, i) causing creation of the first zone scene, ii) causing an indication of the first zone scene to be transmitted to the first zone player, and iii) causing storage of the first zone scene;

receiving a second request to create a second zone scene comprising a second predefined grouping of zone players including at least the first zone player and a third zone player that are to be configured for synchronous playback of media when the second zone scene is invoked, wherein the third zone player is different than the second zone player;

based on the second request, i) causing creation of the second zone scene, ii) causing an indication of the second zone scene to be transmitted to the first zone player, and iii) causing storage of the second zone scene; displaying a representation of the first zone scene and a representation of the second zone scene; and while displaying the representation of the first zone scene and the representation of the second zone scene, receiving a third request to invoke the first zone scene; and

based on the third request, causing the first zone player to transition from operating in the standalone mode to operating in accordance with the first predefined grouping of zone players such that the first zone player is configured to coordinate with at least the second zone player to output media in synchrony with output of media by at least the second zone player.

2. The computing device of claim **1**, further comprising program instructions stored on the non-transitory computer-readable medium that, when executed by the one or more processors, cause the computing device to perform functions comprising:

while the first zone player is configured to coordinate with at least the second zone player to play back media in synchrony with at least the second zone player, receiving a fourth request to invoke the second zone scene; and

based on the fourth request, causing the first zone player to (a) cease to operate in accordance with the first predefined grouping of zone players such that the first zone player is no longer configured to coordinate with at least the second zone player to output media in synchrony with output of media by at least the second zone player and (b) begin to operate in accordance with the second predefined grouping of zone players such that the first zone player is configured to coordinate with at least the third zone player to output media in synchrony with output of media by at least the third zone player.

3. The computing device of claim **1**, wherein causing storage of the first zone scene comprises causing storage of the first zone scene at a location other than the computing device, and wherein causing storage of the second zone scene comprises causing storage of the second zone scene at the location other than the computing device.

4. The computing device of claim **3**, wherein the location other than the computing device comprises a zone player of the first predefined grouping of zone players.

5. The computing device of claim **1**, wherein the first zone scene further comprises an indication of predetermined media to be played when the first zone scene is invoked, and wherein the computing device further comprises program instructions stored on the non-transitory computer-readable medium that, when executed by the one or more processors, cause the computing device to perform functions comprising:

based on the third request, causing the first zone player to coordinate with at least the second zone player to output the predetermined media in synchrony with output of the predetermined media by at least the second zone player.

6. The computing device of claim **1**, wherein the first predefined grouping of zone players does not include the third zone player, and wherein the second predefined grouping of zone players does not include the second zone player.

7. The computing device of claim **1**, further comprising program instructions stored on the non-transitory computer-readable medium that, when executed by the one or more processors, cause the computing device to perform functions comprising:

before displaying the representation of the first zone scene and the representation of the second zone scene, receiving, from another device over a data network, data defining the first zone scene and data defining the second zone scene.

8. The computing device of claim **1**, wherein receiving the first request comprises receiving a first set of one or more inputs via a user interface of the computing device, wherein receiving the second request comprises receiving a second set of one or more inputs via the user interface, and wherein receiving the third request comprises receiving a third set of one or more inputs via the user interface.

9. A non-transitory computer-readable medium, wherein the non-transitory computer-readable medium is provisioned with program instructions that are executable to cause a computing device to perform functions comprising:

while serving as a controller for a networked media playback system comprising a first zone player and at least two other zone players, wherein the first zone player is operating in a standalone mode in which the first zone player is configured to play back media individually:

receiving a first request to create a first zone scene comprising a first predefined grouping of zone players including at least the first zone player and a second zone player that are to be configured for synchronous playback of media when the first zone scene is invoked;

based on the first request, i) causing creation of the first zone scene, ii) causing an indication of the first zone scene to be transmitted to the first zone player, and iii) causing storage of the first zone scene;

receiving a second request to create a second zone scene comprising a second predefined grouping of zone players including at least the first zone player and a third zone player that are to be configured for synchronous playback of media when the second zone scene is invoked, wherein the third zone player is different than the second zone player;

based on the second request, i) causing creation of the second zone scene, ii) causing an indication of the second zone scene to be transmitted to the first zone player, and iii) causing storage of the second zone scene;

displaying a representation of the first zone scene and a representation of the second zone scene; and

while displaying the representation of the first zone scene and the representation of the second zone scene, receiving a third request to invoke the first zone scene; and

based on the third request, causing the first zone player to transition from operating in the standalone mode to operating in accordance with the first predefined grouping of zone players such that the first zone player is configured to coordinate with at least the second zone player to output media in synchrony with output of media by at least the second zone player.

10. The non-transitory computer-readable medium of claim **9**, wherein the non-transitory computer-readable medium is also provisioned with program instructions stored on the non-transitory computer-readable medium that, when executed by the one or more processors, cause the computing device to perform functions comprising:

while the first zone player is configured to coordinate with at least the second zone player to play back media in synchrony with at least the second zone player, receiving a fourth request to invoke the second zone scene; and

based on the fourth request, causing the first zone player to (a) cease to operate in accordance with the first predefined grouping of zone players such that the first zone player is no longer configured to coordinate with at least the second zone player to output media in synchrony with output of media by at least the second zone player and (b) begin to operate in accordance with the second predefined grouping of zone players such that the first zone player is configured to coordinate with at least the third zone player to output media in synchrony with output of media by at least the third zone player.

11. The non-transitory computer-readable medium of claim **9**, wherein causing storage of the first zone scene comprises causing storage of the first zone scene at a location other than the computing device, and wherein causing storage of the second zone scene comprises causing storage of the second zone scene at the location other than the computing device.

12. The non-transitory computer-readable medium of claim **11**, wherein the location other than the computing device comprises a zone player of the first predefined grouping of zone players.

13. The non-transitory computer-readable medium of claim **9**, wherein the first zone scene further comprises an indication of predetermined media to be played when the first zone scene is invoked, and wherein the non-transitory computer-readable medium is also provisioned with program instructions stored on the non-transitory computer-readable medium that, when executed by the one or more processors, cause the computing device to perform functions comprising:

based on the third request, causing the first zone player to coordinate with at least the second zone player to output the predetermined media in synchrony with output of the predetermined media by at least the second zone player.

14. The non-transitory computer-readable medium of claim **9**, wherein the first predefined grouping of zone players does not include the third zone player, and wherein the second predefined grouping of zone players does not include the second zone player.

15. The non-transitory computer-readable medium of claim **9**, wherein the non-transitory computer-readable medium further comprises program instructions stored on the non-transitory computer-readable medium that, when executed by the one or more processors, cause the computing device to perform functions comprising:

before displaying the representation of the first zone scene and the representation of the second zone scene, receiving, from another device over a data network, data defining the first zone scene and data defining the second zone scene.

16. The non-transitory computer-readable medium of claim **9**, wherein receiving the first request comprises receiving a first set of one or more inputs via a user interface of the computing device, wherein receiving the second request comprises receiving a second set of one or more inputs via the user interface, and wherein receiving the third request comprises receiving a third set of one or more inputs via the user interface.

17. A method executed by a computing device, the method comprising:

while serving as a controller for a networked media playback system comprising a first zone player and at least two other zone players, wherein the first zone

player is operating in a standalone mode in which the first zone player is configured to play back media individually:

receiving a first request to create a first zone scene comprising a first predefined grouping of zone players including at least the first zone player and a second zone player that are to be configured for synchronous playback of media when the first zone scene is invoked;

based on the first request, i) causing creation of the first zone scene, ii) causing an indication of the first zone scene to be transmitted to the first zone player, and iii) causing storage of the first zone scene;

receiving a second request to create a second zone scene comprising a second predefined grouping of zone players including at least the first zone player and a third zone player that are to be configured for synchronous playback of media when the second zone scene is invoked, wherein the third zone player is different than the second zone player;

based on the second request, i) causing creation of the second zone scene, ii) causing an indication of the second zone scene to be transmitted to the first zone player, and iii) causing storage of the second zone scene;

displaying a representation of the first zone scene and a representation of the second zone scene; and

while displaying the representation of the first zone scene and the representation of the second zone scene, receiving a third request to invoke the first zone scene; and based on the third request, causing the first zone player to transition from operating in the standalone mode to operating in accordance with the first predefined grouping of zone players such that the first zone player is configured to coordinate with at least the second zone player to output media in synchrony with output of media by at least the second zone player.

18. The method of claim **17**, further comprising:

while the first zone player is configured to coordinate with at least the second zone player to play back media in synchrony with at least the second zone player, receiving a fourth request to invoke the second zone scene; and

based on the fourth request, causing the first zone player to (a) cease to operate in accordance with the first predefined grouping of zone players such that the first zone player is no longer configured to coordinate with at least the second zone player to output media in synchrony with output of media by at least the second zone player and (b) begin to operate in accordance with the second predefined grouping of zone players such that the first zone player is configured to coordinate with at least the third zone player to output media in synchrony with output of media by at least the third zone player.

19. The method of claim **17**, wherein causing storage of the first zone scene comprises causing storage of the first zone scene at a location other than the computing device, wherein causing storage of the second zone scene comprises causing storage of the second zone scene at the location other than the computing device.

20. The method of claim **19**, wherein the location other than the computing device comprises a zone player of the first predefined grouping of zone players.

* * * * *

EXHIBIT 5

US009219460B2

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Bush

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(54) **AUDIO SETTINGS BASED ON ENVIRONMENT**

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CPC ***H03G 5/165*** (2013.01); ***H04R 3/00*** (2013.01); ***H04R 29/00*** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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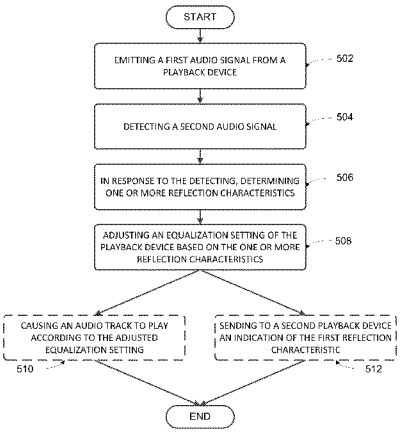
(57) **ABSTRACT**

Embodiments described herein may involve dynamically adjusting the equalization of a playback device based on the environment in which the playback device is operating. One embodiment may involve emitting a first audio signal from a playback device, detecting, by the playback device, a second audio signal, where at least a portion of the second audio signal is a reflection of the first audio signal, in response to the detecting, determining one or more reflection characteristics, where each of the one or more reflection characteristics are based on at least the second audio signal, adjusting an equalization setting of the playback device based on the one or more reflection characteristics, and causing an audio track to play according to the adjusted equalization setting.

20 Claims, 9 Drawing Sheets



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2010/0195846	A1 *	8/2010	Yokoyama	H03G 7/007 381/102
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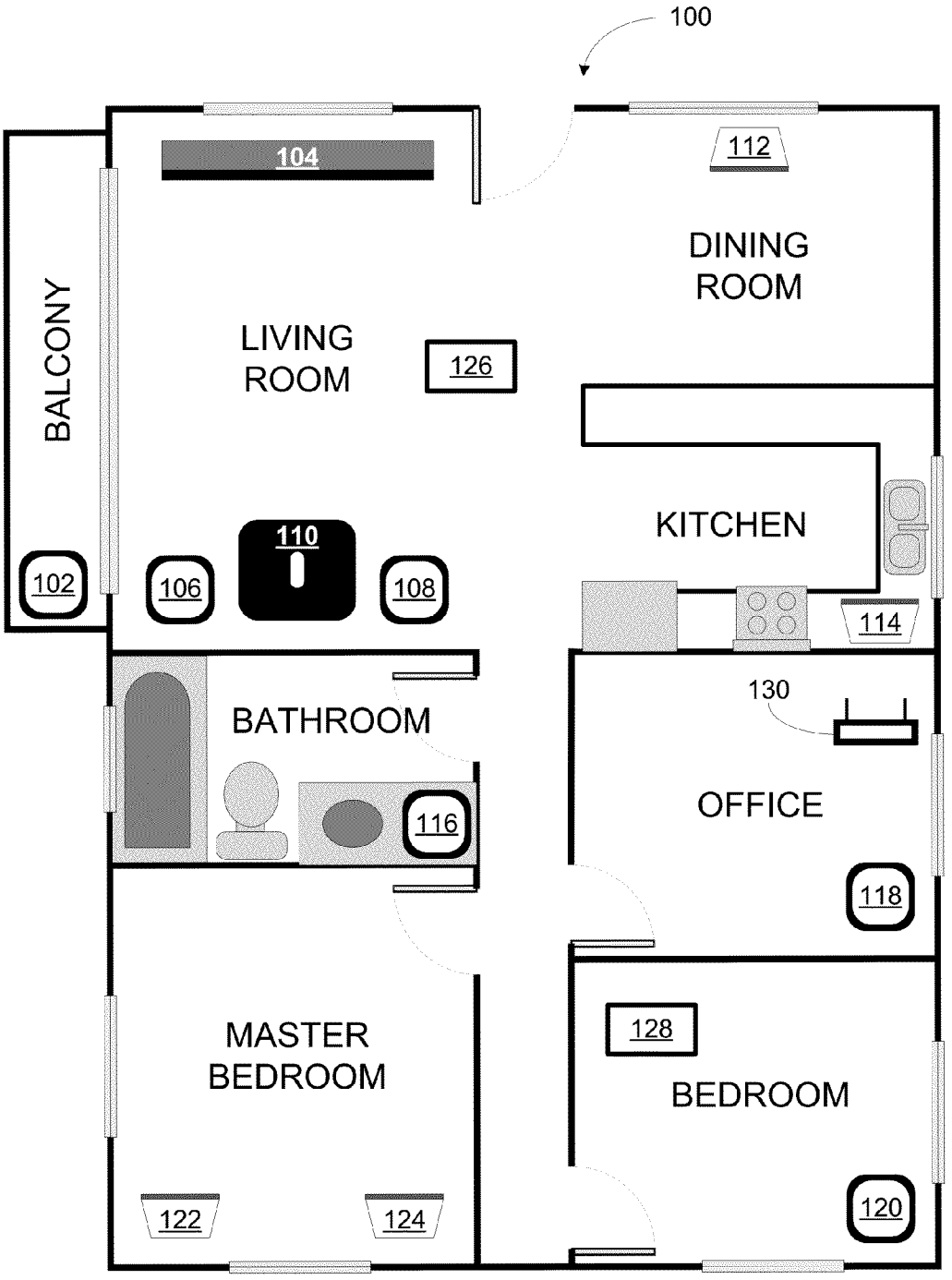

100
104
112
DINING ROOM
BALCONY
LIVING ROOM
126
KITCHEN
110
102
106
108
114
BATHROOM
130
OFFICE
116
118
MASTER BEDROOM
128
BEDROOM
122
124
120

FIGURE 1

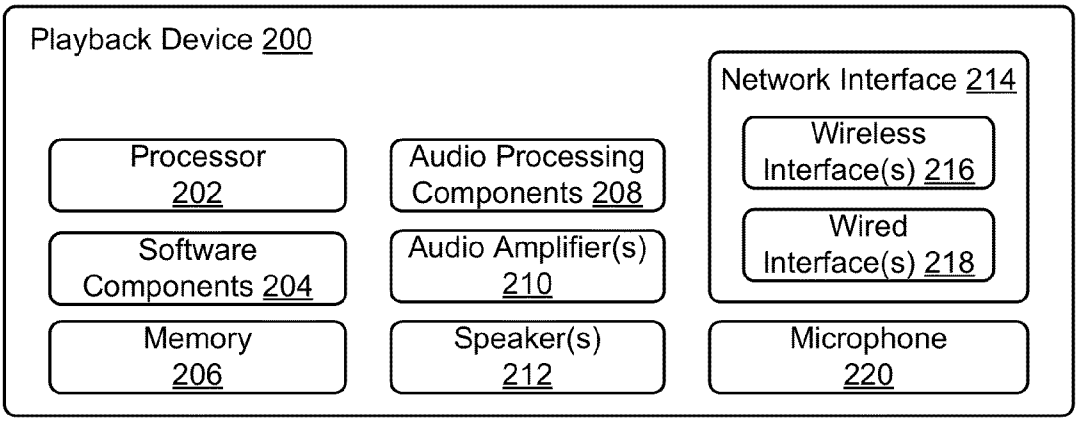


FIGURE 2

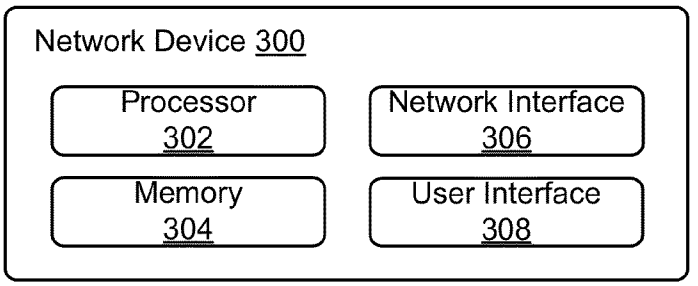


FIGURE 3

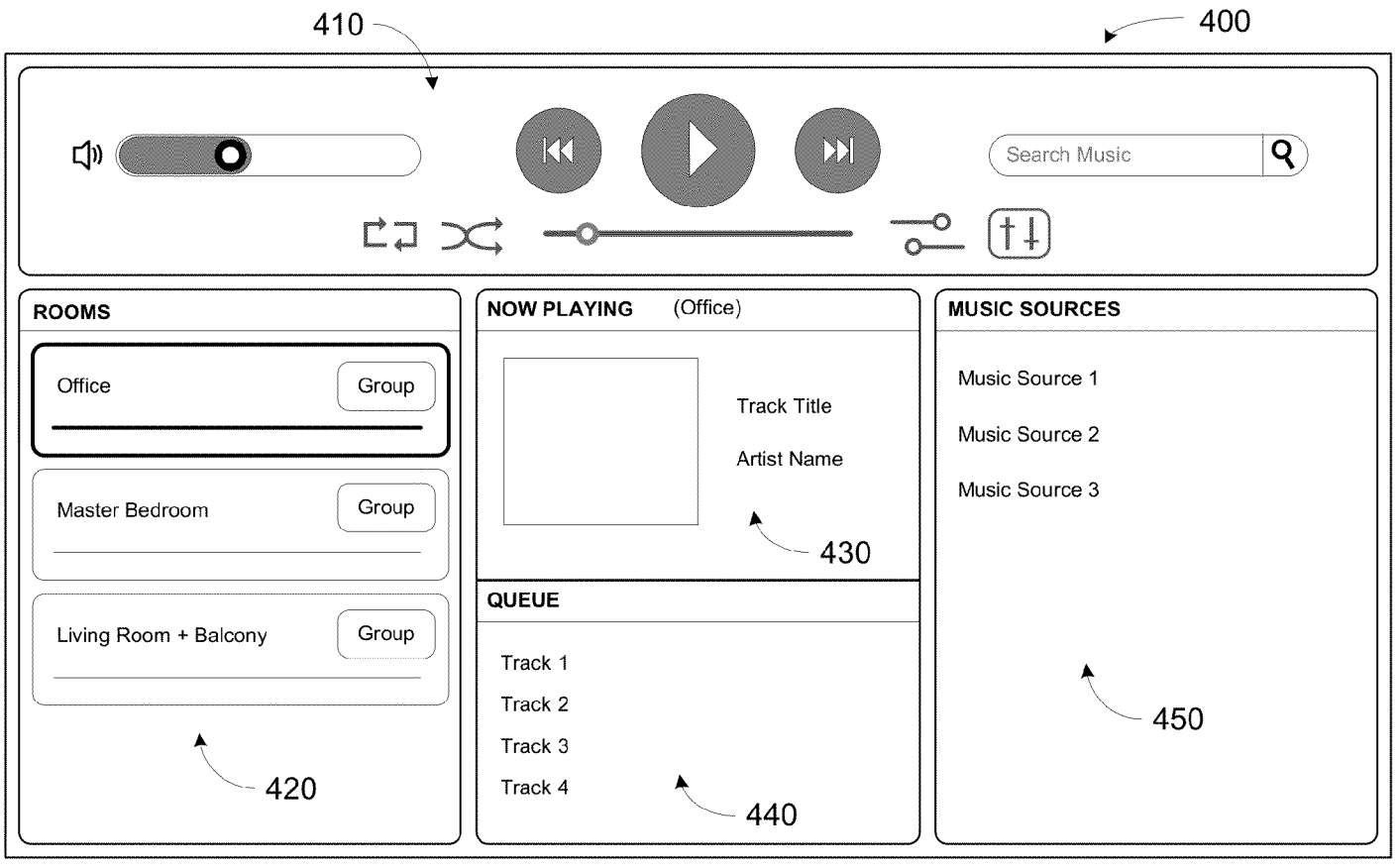

410
400
Search Music
ROOMS
Office
Group
Master Bedroom
Group
Living Room + Balcony
Group
420
NOW PLAYING
(Office)
Track Title
Artist Name
430
QUEUE
Track 1
Track 2
Track 3
Track 4
440
MUSIC SOURCES
Music Source 1
Music Source 2
Music Source 3
450

FIGURE 4

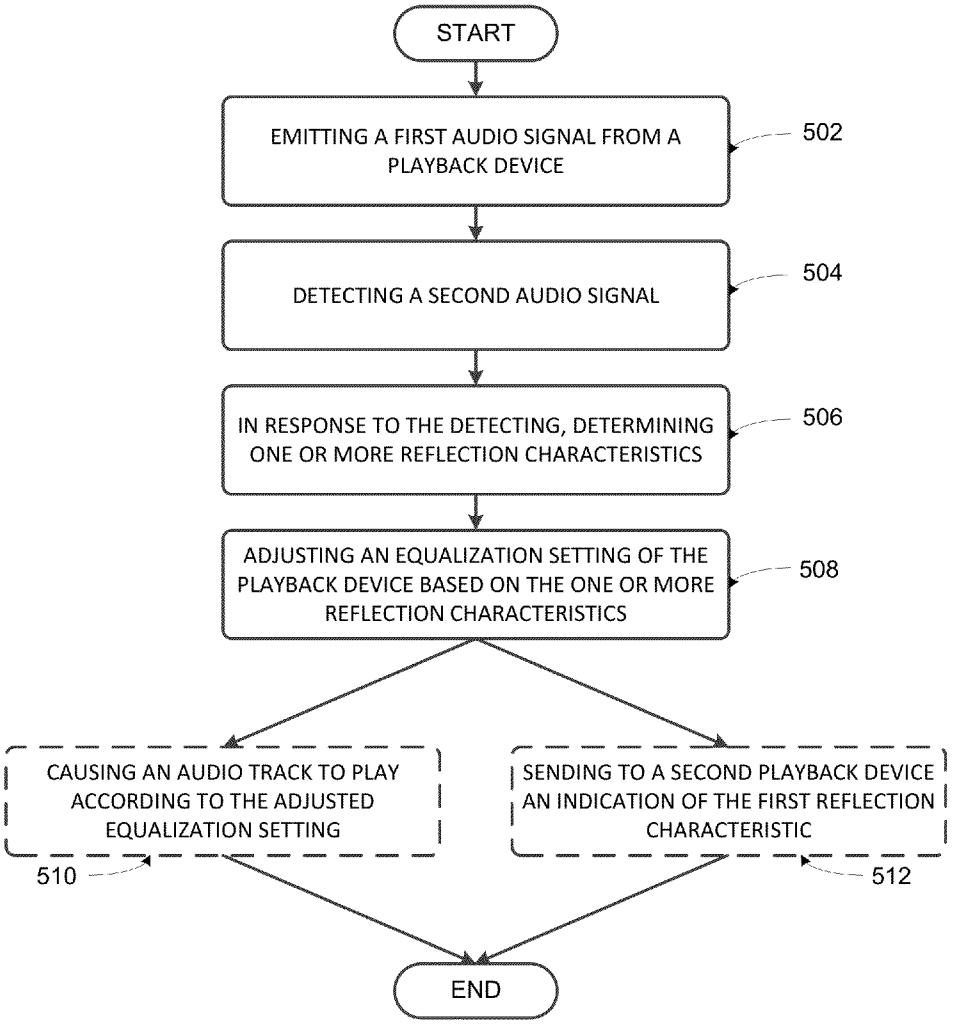

START
EMITTING A FIRST AUDIO SIGNAL FROM A PLAYBACK DEVICE
502
DETECTING A SECOND AUDIO SIGNAL
504
IN RESPONSE TO THE DETECTING, DETERMINING ONE OR MORE REFLECTION CHARACTERISTICS
506
ADJUSTING AN EQUALIZATION SETTING OF THE PLAYBACK DEVICE BASED ON THE ONE OR MORE REFLECTION CHARACTERISTICS
508
CAUSING AN AUDIO TRACK TO PLAY ACCORDING TO THE ADJUSTED EQUALIZATION SETTING
510
SENDING TO A SECOND PLAYBACK DEVICE AN INDICATION OF THE FIRST REFLECTION CHARACTERISTIC
512
END

FIGURE 5

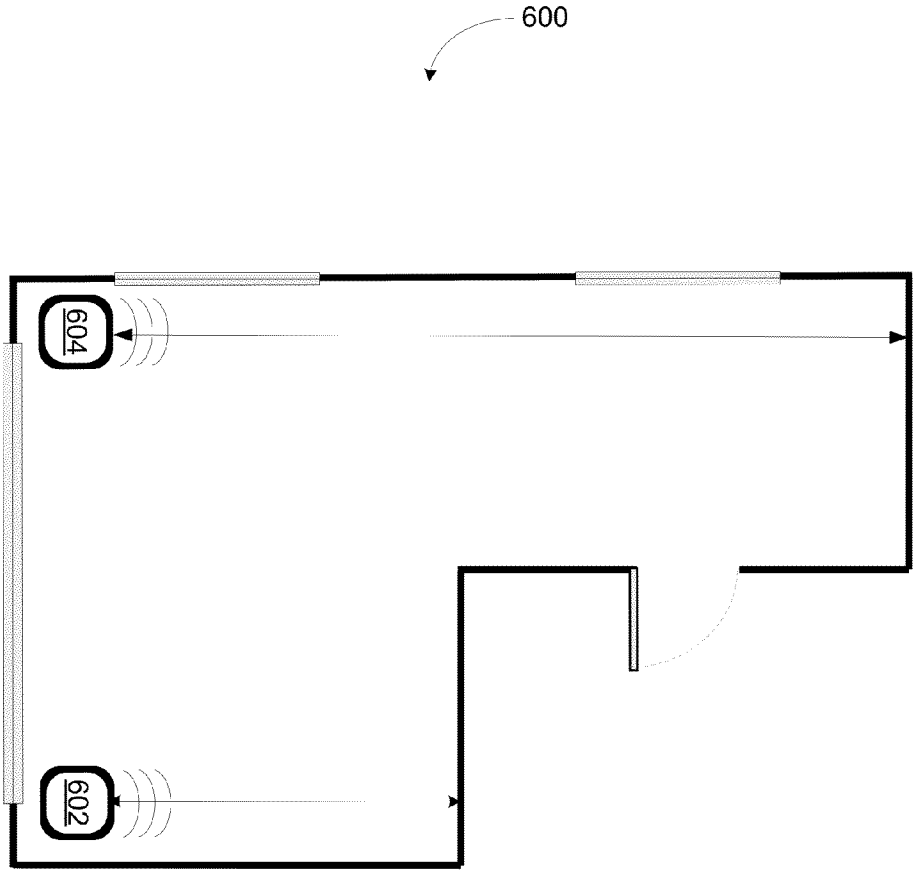


FIGURE 6

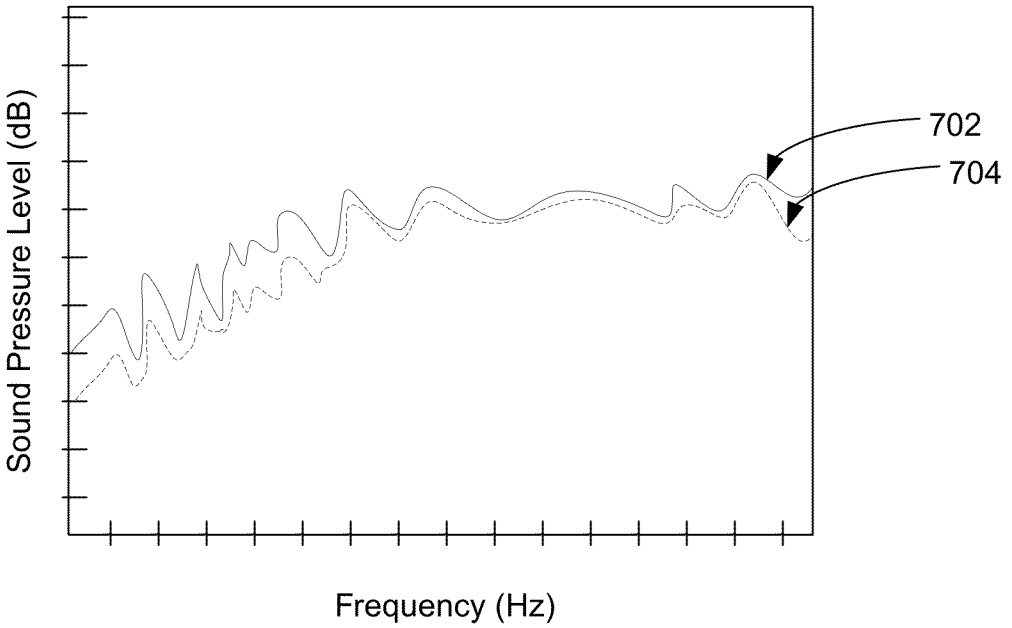


FIGURE 7

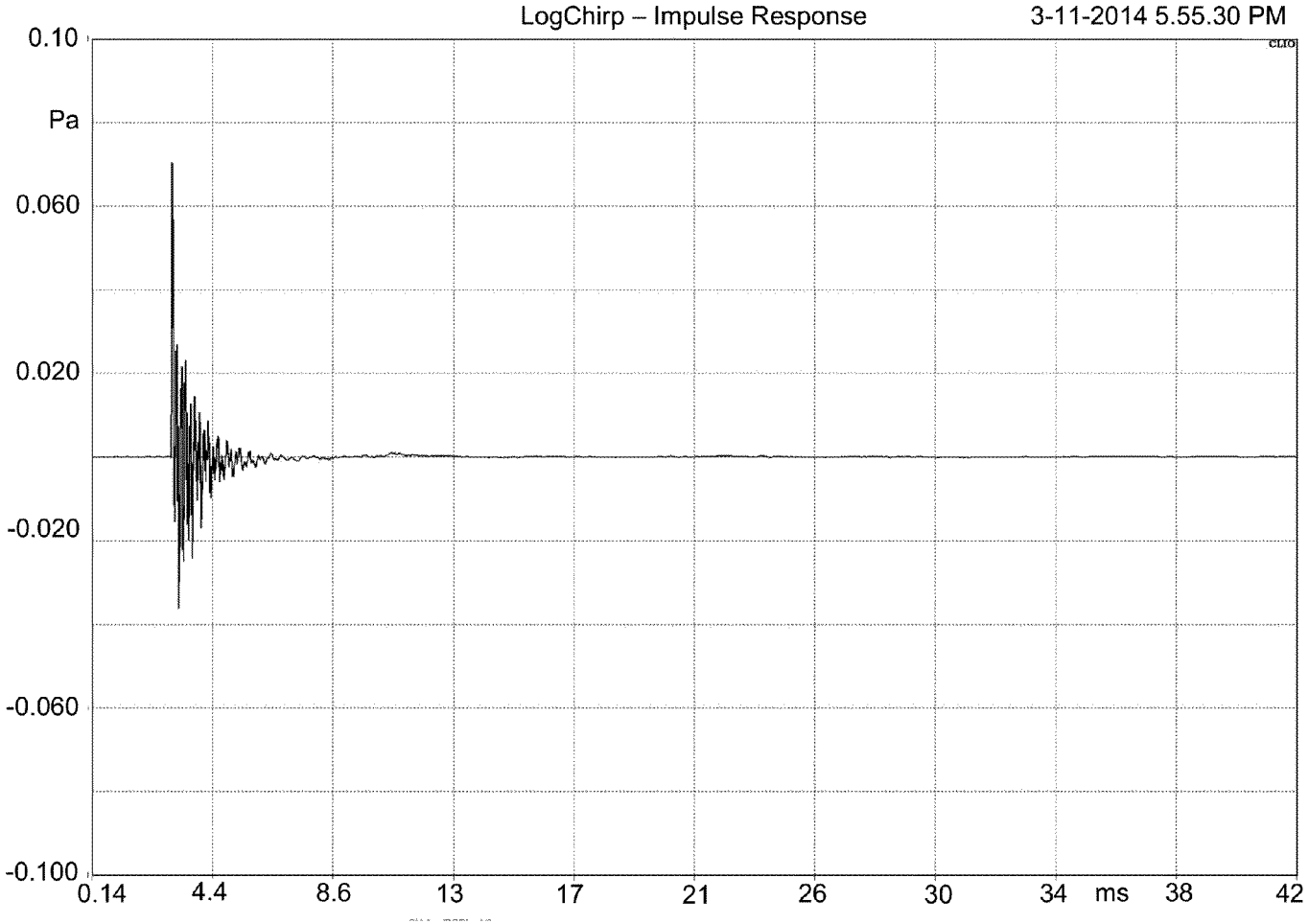

LogChirp – Impulse Response
3-11-2014 5.55.30 PM
0.10
Pa
0.060
0.020
-0.020
-0.060
-0.100
0.14
4.4
8.6
13
17
21
26
30
34
ms
38
42
Ax: 0.1433ms Ay: 0.0000 Pa Az: 0.0493m
CH A dBSPL 1/3 Octave 9kHz 262K Rectangular Start 0.15ms Stop 42.21ms FreqLO 23.66Hz Length 42.26 ms
File:

FIGURE 8A

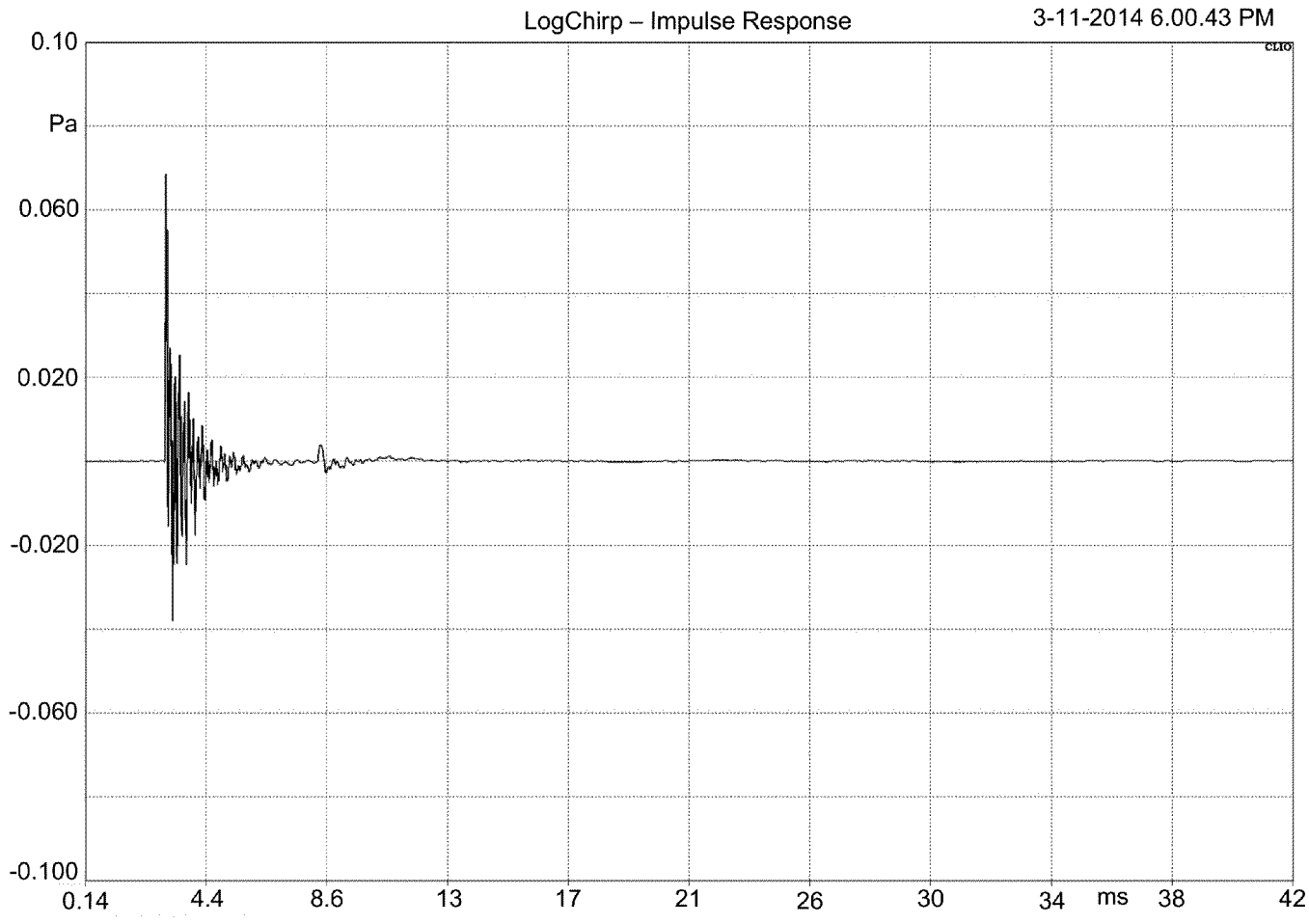
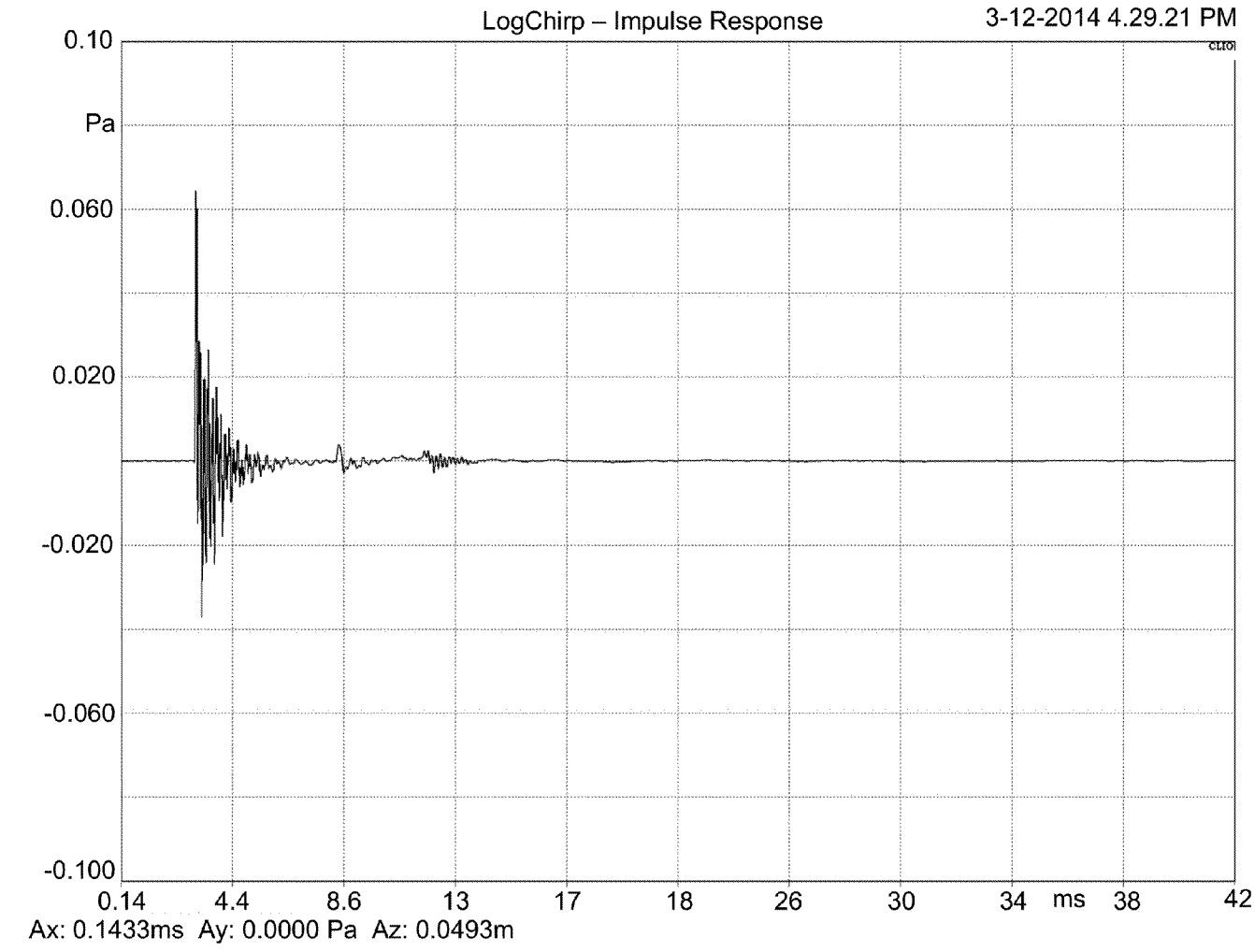

LogChirp – Impulse Response
3-11-2014 6.00.43 PM
CLIO
0.10
Pa
0.060
0.020
-0.020
-0.060
-0.100
0.14
4.4
8.6
13
17
21
26
30
34
ms
38
42
Ax: 0.1433ms Ay: 0.0000 Pa Az: 0.0493m
CH A dBSPL 1/3 Octave 9kHz 262K Rectangular Start 0.15ms Stop 42.21ms FreqLO 23.66Hz Length 42.26 ms
File:

FIGURE 8B



File: CH A dBSPL 1/3 Octave 9kHz 262K Rectangular Start 0.15ms Stop 42.21ms FreqLO 23.66Hz Length 42.26 ms

FIGURE 8C

AUDIO SETTINGS BASED ON ENVIRONMENT

FIELD OF THE DISCLOSURE

The disclosure is related to consumer goods and, more particularly, to methods, systems, products, features, services, and other elements directed to media playback or some aspect thereof.

BACKGROUND

Options for accessing and listening to digital audio in an out-loud setting were limited until in 2003, when SONOS, Inc. filed for one of its first patent applications, entitled "Method for Synchronizing Audio Playback between Multiple Networked Devices," and began offering a media playback system for sale in 2005. The Sonos Wireless HiFi System enables people to experience music from many sources via one or more networked playback devices. Through a software control application installed on a smartphone, tablet, or computer, one can play what he or she wants in any room that has a networked playback device. Additionally, using the controller, for example, different songs can be streamed to each room with a playback device, rooms can be grouped together for synchronous playback, or the same song can be heard in all rooms synchronously.

Given the ever growing interest in digital media, there continues to be a need to develop consumer-accessible technologies to further enhance the listening experience.

BRIEF DESCRIPTION OF THE DRAWINGS

Features, aspects, and advantages of the presently disclosed technology may be better understood with regard to the following description, appended claims, and accompanying drawings where:

FIG. **1** shows an example media playback system configuration in which certain embodiments may be practiced;

FIG. **2** shows a functional block diagram of an example playback device;

FIG. **3** shows a functional block diagram of an example control device;

FIG. **4** shows an example controller interface;

FIG. **5** shows an example flow diagram for dynamically adjusting the equalization of a playback device based on the environment in which the playback device is operating;

FIG. **6** shows another example media playback system configuration in which certain embodiments may be practiced; and

FIG. **7** shows illustrative frequency responses of the playback device.

FIGS. **8**A-**8**C show example impulse responses of a playback device.

The drawings are for the purpose of illustrating example embodiments, but it is understood that the inventions are not limited to the arrangements and instrumentality shown in the drawings.

DETAILED DESCRIPTION

I. Overview

Embodiments described herein involve dynamically adjusting the equalization of a playback device based on the environment in which the playback device is operating. While a playback device may be factory configured to perform

advantageously in a typical operating environment, the factory configuration may not be ideal for all environments. Therefore, adjusting the equalization of the playback device based on the current operating environment may improve the listening experience for some listeners.

Consider that, as one example, a playback device may be configured to perform advantageously in a small room, but nonetheless may come to be positioned outdoors. When operating outdoors, boosting the bass levels of the playback may result in an improved listening experience for some users. Other such examples may exist as well.

Some audio playback systems implement a manual approach for adjustment of equalization based on environment. Under this approach, a microphone is cabled to a given component of an audio system, such as an amplifier or an audio-video receiver. A user is then expected to position the microphone in a position in which the user would typically listen to the audio system. The given component of the audio system then drives audio output to one or more speakers. Then, the speaker output is detected by the microphone. Playback of the audio component is then adjusted based on the speaker output detected by the microphone.

Such a manual approach has several disadvantages. First, the adjustment process is often overlooked by the user because, for example, the user may be required to initiate the adjustment and position the microphone. Second, the adjustment process requires a separate microphone, which may not be included with any of the components of the audio system. Third, the manual approach does not lend itself to frequent adjustment when one or more of the speakers may be repositioned in different locations throughout a home or outdoors. Therefore, an improved, dynamic approach to adjustment based on environment is desired.

Described herein are example methods and systems for dynamically adjusting equalization of a playback device based on the environment in which the playback device is operating. An example playback device may include a speaker, a microphone, and a processor. The playback device may emit an audio signal, such as a pulse, from the speaker. As the audio signal propagates, the signal may encounter various objects, such as walls and furniture, throughout the environment. When an object is encountered, the object may variably reflect or absorb portions of the audio signal. For instance, when the audio signal encounters an interior wall, a portion of the audio signal may be reflected by the interior wall. The portion of the audio signal may then encounter other objects that variably reflect or absorb some of the portion in turn. At some point, a portion of the reflected audio signal may reflect back toward the playback device from which the audio signal was emitted. The microphone of the playback device may then detect at least a portion of the reflected audio signal.

In response to detecting the reflected audio signal, the playback device may determine one or more reflection characteristics based on the reflected audio signal. For example, the playback device may determine an amount of time from when the playback device emitted the first audio signal to when the playback device detected the reflected audio signal. The amount of time may indicate the nature of the environment. For instance, a relatively short amount of time may indicate that the playback device is in a small room while a relatively amount of time may indicate that the playback device is in a large room. Alternatively, the playback device may determine the sound pressure level of the second audio signal. A relatively low sound pressure level may indicate that there is relatively more absorptive material in the environment as compared with a relatively higher sound pressure

level. Or the relatively low sound pressure level may indicate that the first audio signal travelled a relatively longer distance before reflecting. Other reflection characteristics may exist, as may many other examples of indications regarding the nature of the environment.

The playback device may then adjust an equalization setting of the playback device based on the one or more reflection characteristics. Further, two or more reflection characteristics may be used in combination. For instance, a relatively long amount of time and a relatively low sound pressure level may indicate that the playback device is either presumed to be outside or in a very large room. In either case, the playback device may adjust the equalization setting based on that environment. In the above instance, where the playback device is either outside or in a very large room, the bass frequencies of the playback device may be increased, which may, to some listeners, improve enjoyment of the audio played by the playback device in the more spacious environment. In contrast, where the reflection characteristics indicate that the playback device is in a small room, the bass frequencies of the playback device may be decreased, which may improve enjoyment of the audio played by the playback device in the small room. Once the equalization setting is adjusted, the playback device may then play an audio track according to the equalization setting.

As indicated above, the present application involves dynamically adjusting the equalization of a playback device based on the environment in which the playback device is operating. In one aspect, a method is provided. The method involves emitting, by a playback device, a first audio signal, detecting, by the playback device, a second audio signal, where at least a portion of the second audio signal is a reflection of the first audio signal, in response to the detecting, determining one or more reflection characteristics, where each of the one or more reflection characteristics are based on at least the second audio signal, adjusting an equalization setting of the playback device based on the one or more reflection characteristics; and causing an audio track to play according to the adjusted equalization setting.

In another aspect, a second method is provided. The second method is operable in a media playback system comprising a plurality of playback devices, where each playback device comprises a respective microphone and a respective speaker. The second method involves receiving an indication of a first audio signal, detecting, by a microphone of the first playback device, a second audio signal, where at least a portion of the second audio signal is indicative of the first audio signal, in response to the detecting, determining a first reflection characteristic based on the second audio signal, adjusting an equalization setting of the first playback device based on at least the first reflection characteristic, and sending to a second media playback device an indication of the first reflection characteristic.

In another aspect, a device is provided. The device includes a speaker, a microphone that is physically coupled to the speaker, a processor, a network interface, a data storage, and a program logic stored in the data storage. The program logic is executable by the processor to emit a first audio signal from the speaker, detect, via the microphone, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal, in response to the detecting, determine a first reflection characteristic based on at least the second audio signal, adjust an equalization setting of the playback device based on at least the first reflection characteristic, and play, via the speaker, an audio track according to the equalization setting.

In yet another aspect, a non-transitory computer readable memory is provided. The non-transitory computer readable memory has stored thereon instructions executable by a computing device to cause the computing device to perform functions. The functions include emitting, by a playback device, a first audio signal, detecting, by the playback device, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal, in response to the detecting, determining one or more reflection characteristics, wherein each of the one or more reflection characteristics are based on at least the second audio signal, adjusting an equalization setting of the playback device based on the one or more reflection characteristics; and causing an audio track to play according to the adjusted equalization setting.

It will be understood by one of ordinary skill in the art that this disclosure includes numerous other embodiments.

II. Example Operating Environment

FIG. **1** shows an example configuration of a media playback system **100** in which one or more embodiments disclosed herein may be practiced or implemented. The media playback system **100** as shown is associated with an example home environment having several rooms and spaces, such as for example, a master bedroom, an office, a dining room, and a living room. As shown in the example of FIG. **1**, the media playback system **100** includes playback devices **102-124**, control devices **126** and **128**, and a wired or wireless network router **130**.

Further discussions relating to the different components of the example media playback system **100** and how the different components may interact to provide a user with a media experience may be found in the following sections. While discussions herein may generally refer to the example media playback system **100**, technologies described herein are not limited to applications within, among other things, the home environment as shown in FIG. **1**. For instance, the technologies described herein may be useful in environments where multi-zone audio may be desired, such as, for example, a commercial setting like a restaurant, mall or airport, a vehicle like a sports utility vehicle (SUV), bus or car, a ship or boat, an airplane, and so on.

a. Example Playback Devices

FIG. **2** shows a functional block diagram of an example playback device **200** that may be configured to be one or more of the playback devices **102-124** of the media playback system **100** of FIG. **1**. The playback device **200** may include a processor **202**, software components **204**, memory **206**, audio processing components **208**, audio amplifier(s) **210**, speaker (s) **212**, a network interface **214** including wireless interface (s) **216** and wired interface(s) **218** and a microphone **220**. In one case, the playback device **200** may not include the speaker(s) **212**, but rather a speaker interface for connecting the playback device **200** to external speakers. In another case, the playback device **200** may include neither the speaker(s) **212** nor the audio amplifier(s) **210**, but rather an audio interface for connecting the playback device **200** to an external audio amplifier or audio-visual receiver.

In one example, the processor **202** may be a clock-driven computing component configured to process input data according to instructions stored in the memory **206**. The memory **206** may be a tangible computer-readable medium configured to store instructions executable by the processor **202**. For instance, the memory **206** may be data storage that can be loaded with one or more of the software components **204** executable by the processor **202** to achieve certain functions. In one example, the functions may involve the playback

device **200** retrieving audio data from an audio source or another playback device. In another example, the functions may involve the playback device **200** sending audio data to another device or playback device on a network. In yet another example, the functions may involve pairing of the playback device **200** with one or more playback devices to create a multi-channel audio environment.

Certain functions may involve the playback device **200** synchronizing playback of audio content with one or more other playback devices. During synchronous playback, a listener will preferably not be able to perceive time-delay differences between playback of the audio content by the playback device **200** and the one or more other playback devices. U.S. Pat. No. 8,234,395 entitled, "System and method for synchronizing operations among a plurality of independently clocked digital data processing devices," which is hereby incorporated by reference, provides in more detail some examples for audio playback synchronization among playback devices.

The memory **206** may further be configured to store data associated with the playback device **200**, such as one or more zones and/or zone groups the playback device **200** is a part of, audio sources accessible by the playback device **200**, or a playback queue that the playback device **200** (or some other playback device) may be associated with. The data may be stored as one or more state variables that are periodically updated and used to describe the state of the playback device **200**. The memory **206** may also include the data associated with the state of the other devices of the media system, and shared from time to time among the devices so that one or more of the devices have the most recent data associated with the system. Other embodiments are also possible.

The audio processing components **208** may include one or more digital-to-analog converters (DAC), an audio preprocessing component, an audio enhancement component or a digital signal processor (DSP), and so on. In one embodiment, one or more of the audio processing components **208** may be a subcomponent of the processor **202**. In one example, audio content may be processed and/or intentionally altered by the audio processing components **208** to produce audio signals. The produced audio signals may then be provided to the audio amplifier(s) **210** for amplification and playback through speaker(s) **212**. Particularly, the audio amplifier(s) **210** may include devices configured to amplify audio signals to a level for driving one or more of the speakers **212**. The speaker(s) **212** may include an individual transducer (e.g., a "driver") or a complete speaker system involving an enclosure with one or more drivers. A particular driver of the speaker(s) **212** may include, for example, a subwoofer (e.g., for low frequencies), a mid-range driver (e.g., for middle frequencies), and/or a tweeter (e.g., for high frequencies). In some cases, each transducer in the one or more speakers **212** may be driven by an individual corresponding audio amplifier of the audio amplifier(s) **210**. In addition to producing analog signals for playback by the playback device **200**, the audio processing components **208** may be configured to process audio content to be sent to one or more other playback devices for playback.

Audio content to be processed and/or played back by the playback device **200** may be received from an external source, such as via an audio line-in input connection (e.g., an auto-detecting 3.5 mm audio line-in connection) or the network interface **214**.

The network interface **214** may be configured to facilitate a data flow between the playback device **200** and one or more other devices on a data network. As such, the playback device **200** may be configured to receive audio content over the data network from one or more other playback devices in communication with the playback device **200**, network devices within a local area network, or audio content sources over a wide area network such as the Internet. In one example, the audio content and other signals transmitted and received by the playback device **200** may be transmitted in the form of digital packet data containing an Internet Protocol (IP)-based source address and IP-based destination addresses. In such a case, the network interface **214** may be configured to parse the digital packet data such that the data destined for the playback device **200** is properly received and processed by the playback device **200**.

As shown, the network interface **214** may include wireless interface(s) **216** and wired interface(s) **218**. The wireless interface(s) **216** may provide network interface functions for the playback device **200** to wirelessly communicate with other devices (e.g., other playback device(s), speaker(s), receiver(s), network device(s), control device(s) within a data network the playback device **200** is associated with) in accordance with a communication protocol (e.g., any wireless standard including IEEE 802.11a, 802.11b, 802.11g, 802.11n, 802.11 ac, 802.15, 4G mobile communication standard, and so on). The wired interface(s) **218** may provide network interface functions for the playback device **200** to communicate over a wired connection with other devices in accordance with a communication protocol (e.g., IEEE 802.3). While the network interface **214** shown in FIG. **2** includes both wireless interface(s) **216** and wired interface(s) **218**, the network interface **214** may in some embodiments include only wireless interface(s) or only wired interface(s).

The microphone **220** may be arranged to detect sound in the environment of the playback device **200**. For instance, the microphone may be mounted on an exterior wall of a housing of the playback device. The microphone may be any type of microphone now known or later developed such as a condenser microphone, electret condenser microphone, or a dynamic microphone. The microphone may be sensitive to a portion of the frequency range of the speaker(s) **220**. One or more of the speaker(s) **220** may operate in reverse as the microphone **220**.

In one example, the playback device **200** and one other playback device may be paired to play two separate audio components of audio content. For instance, playback device **200** may be configured to play a left channel audio component, while the other playback device may be configured to play a right channel audio component, thereby producing or enhancing a stereo effect of the audio content. The paired playback devices (also referred to as "bonded playback devices") may further play audio content in synchrony with other playback devices.

In another example, the playback device **200** may be sonically consolidated with one or more other playback devices to form a single, consolidated playback device. A consolidated playback device may be configured to process and reproduce sound differently than an unconsolidated playback device or playback devices that are paired, because a consolidated playback device may have additional speaker drivers through which audio content may be rendered. For instance, if the playback device **200** is a playback device designed to render low frequency range audio content (i.e. a subwoofer), the playback device **200** may be consolidated with a playback device designed to render full frequency range audio content. In such a case, the full frequency range playback device, when consolidated with the low frequency playback device **200**, may be configured to render only the mid and high frequency components of audio content, while the low frequency range playback device **200** renders the low frequency component of the audio content. The consolidated playback

device may further be paired with a single playback device or yet another consolidated playback device.

By way of illustration, SONOS, Inc. presently offers (or has offered) for sale certain playback devices including a "PLAY:1," "PLAY:3," "PLAY:5," "PLAYBAR," "CONNECT:AMP," "CONNECT," and "SUB." Any other past, present, and/or future playback devices may additionally or alternatively be used to implement the playback devices of example embodiments disclosed herein. Additionally, it is understood that a playback device is not limited to the example illustrated in FIG. **2** or to the SONOS product offerings. For example, a playback device may include a wired or wireless headphone. In another example, a playback device may include or interact with a docking station for personal mobile media playback devices. In yet another example, a playback device may be integral to another device or component such as a television, a lighting fixture, or some other device for indoor or outdoor use.

b. Example Playback Zone Configurations

Referring back to the media playback system **100** of FIG. **1**, the environment may have one or more playback zones, each with one or more playback devices. The media playback system **100** may be established with one or more playback zones, after which one or more zones may be added, or removed to arrive at the example configuration shown in FIG. **1**. Each zone may be given a name according to a different room or space such as an office, bathroom, master bedroom, bedroom, kitchen, dining room, living room, and/or balcony. In one case, a single playback zone may include multiple rooms or spaces. In another case, a single room or space may include multiple playback zones.

As shown in FIG. **1**, the balcony, dining room, kitchen, bathroom, office, and bedroom zones each have one playback device, while the living room and master bedroom zones each have multiple playback devices. In the living room zone, playback devices **104**, **106**, **108**, and **110** may be configured to play audio content in synchrony as individual playback devices, as one or more bonded playback devices, as one or more consolidated playback devices, or any combination thereof. Similarly, in the case of the master bedroom, playback devices **122** and **124** may be configured to play audio content in synchrony as individual playback devices, as a bonded playback device, or as a consolidated playback device.

In one example, one or more playback zones in the environment of FIG. **1** may each be playing different audio content. For instance, the user may be grilling in the balcony zone and listening to hip hop music being played by the playback device **102** while another user may be preparing food in the kitchen zone and listening to classical music being played by the playback device **114**. In another example, a playback zone may play the same audio content in synchrony with another playback zone. For instance, the user may be in the office zone where the playback device **118** is playing the same rock music that is being playing by playback device **102** in the balcony zone. In such a case, playback devices **102** and **118** may be playing the rock music in synchrony such that the user may seamlessly (or at least substantially seamlessly) enjoy the audio content that is being played out-loud while moving between different playback zones. Synchronization among playback zones may be achieved in a manner similar to that of synchronization among playback devices, as described in previously referenced U.S. Pat. No. 8,234,395.

As suggested above, the zone configurations of the media playback system **100** may be dynamically modified, and in some embodiments, the media playback system **100** supports numerous configurations. For instance, if a user physically moves one or more playback devices to or from a zone, the media playback system **100** may be reconfigured to accommodate the change(s). For instance, if the user physically moves the playback device **102** from the balcony zone to the office zone, the office zone may now include both the playback device **118** and the playback device **102**. The playback device **102** may be paired or grouped with the office zone and/or renamed if so desired via a control device such as the control devices **126** and **128**. On the other hand, if the one or more playback devices are moved to a particular area in the home environment that is not already a playback zone, a new playback zone may be created for the particular area.

Further, different playback zones of the media playback system **100** may be dynamically combined into zone groups or split up into individual playback zones. For instance, the dining room zone and the kitchen zone **114** may be combined into a zone group for a dinner party such that playback devices **112** and **114** may render audio content in synchrony. On the other hand, the living room zone may be split into a television zone including playback device **104**, and a listening zone including playback devices **106**, **108**, and **110**, if the user wishes to listen to music in the living room space while another user wishes to watch television.

c. Example Control Devices

FIG. **3** shows a functional block diagram of an example control device **300** that may be configured to be one or both of the control devices **126** and **128** of the media playback system **100**. As shown, the control device **300** may include a processor **302**, memory **304**, a network interface **306**, and a user interface **308**. In one example, the control device **300** may be a dedicated controller for the media playback system **100**. In another example, the control device **300** may be a network device on which media playback system controller application software may be installed, such as for example, an iPhone™ iPad™ or any other smart phone, tablet or network device (e.g., a networked computer such as a PC or Mac™).

The processor **302** may be configured to perform functions relevant to facilitating user access, control, and configuration of the media playback system **100**. The memory **304** may be configured to store instructions executable by the processor **302** to perform those functions. The memory **304** may also be configured to store the media playback system controller application software and other data associated with the media playback system **100** and the user.

In one example, the network interface **306** may be based on an industry standard (e.g., infrared, radio, wired standards including IEEE 802.3, wireless standards including IEEE 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac, 802.15, 4G mobile communication standard, and so on). The network interface **306** may provide a means for the control device **300** to communicate with other devices in the media playback system **100**. In one example, data and information (e.g., such as a state variable) may be communicated between control device **300** and other devices via the network interface **306**. For instance, playback zone and zone group configurations in the media playback system **100** may be received by the control device **300** from a playback device or another network device, or transmitted by the control device **300** to another playback device or network device via the network interface **306**. In some cases, the other network device may be another control device.

Playback device control commands such as volume control and audio playback control may also be communicated from the control device **300** to a playback device via the network interface **306**. As suggested above, changes to configurations of the media playback system **100** may also be performed by a user using the control device **300**. The configuration

changes may include adding/removing one or more playback devices to/from a zone, adding/removing one or more zones to/from a zone group, forming a bonded or consolidated player, separating one or more playback devices from a bonded or consolidated player, among others. Accordingly, the control device **300** may sometimes be referred to as a controller, whether the control device **300** is a dedicated controller or a network device on which media playback system controller application software is installed.

The user interface **308** of the control device **300** may be configured to facilitate user access and control of the media playback system **100**, by providing a controller interface such as the controller interface **400** shown in FIG. **4**. The controller interface **400** includes a playback control region **410**, a playback zone region **420**, a playback status region **430**, a playback queue region **440**, and an audio content sources region **450**. The user interface **400** as shown is just one example of a user interface that may be provided on a network device such as the control device **300** of FIG. **3** (and/or the control devices **126** and **128** of FIG. **1**) and accessed by users to control a media playback system such as the media playback system **100**. Other user interfaces of varying formats, styles, and interactive sequences may alternatively be implemented on one or more network devices to provide comparable control access to a media playback system.

The playback control region **410** may include selectable (e.g., by way of touch or by using a cursor) icons to cause playback devices in a selected playback zone or zone group to play or pause, fast forward, rewind, skip to next, skip to previous, enter/exit shuffle mode, enter/exit repeat mode, enter/exit cross fade mode. The playback control region **410** may also include selectable icons to modify equalization settings, and playback volume, among other possibilities.

The playback zone region **420** may include representations of playback zones within the media playback system **100**. In some embodiments, the graphical representations of playback zones may be selectable to bring up additional selectable icons to manage or configure the playback zones in the media playback system, such as a creation of bonded zones, creation of zone groups, separation of zone groups, and renaming of zone groups, among other possibilities.

For example, as shown, a "group" icon may be provided within each of the graphical representations of playback zones. The "group" icon provided within a graphical representation of a particular zone may be selectable to bring up options to select one or more other zones in the media playback system to be grouped with the particular zone. Once grouped, playback devices in the zones that have been grouped with the particular zone will be configured to play audio content in synchrony with the playback device(s) in the particular zone. Analogously, a "group" icon may be provided within a graphical representation of a zone group. In this case, the "group" icon may be selectable to bring up options to deselect one or more zones in the zone group to be removed from the zone group. Other interactions and implementations for grouping and ungrouping zones via a user interface such as the user interface **400** are also possible. The representations of playback zones in the playback zone region **420** may be dynamically updated as playback zone or zone group configurations are modified.

The playback status region **430** may include graphical representations of audio content that is presently being played, previously played, or scheduled to play next in the selected playback zone or zone group. The selected playback zone or zone group may be visually distinguished on the user interface, such as within the playback zone region **420** and/or the playback status region **430**. The graphical representations may include track title, artist name, album name, album year, track length, and other relevant information that may be useful for the user to know when controlling the media playback system via the user interface **400**.

The playback queue region **440** may include graphical representations of audio content in a playback queue associated with the selected playback zone or zone group. In some embodiments, each playback zone or zone group may be associated with a playback queue containing information corresponding to zero or more audio items for playback by the playback zone or zone group. For instance, each audio item in the playback queue may comprise a uniform resource identifier (URI), a uniform resource locator (URL) or some other identifier that may be used by a playback device in the playback zone or zone group to find and/or retrieve the audio item from a local audio content source or a networked audio content source, possibly for playback by the playback device.

In one example, a playlist may be added to a playback queue, in which case information corresponding to each audio item in the playlist may be added to the playback queue. In another example, audio items in a playback queue may be saved as a playlist. In a further example, a playback queue may be empty, or populated but "not in use" when the playback zone or zone group is playing continuously streaming audio content, such as Internet radio that may continue to play until otherwise stopped, rather than discrete audio items that have playback durations. In an alternative embodiment, a playback queue can include Internet radio and/or other streaming audio content items and be "in use" when the playback zone or zone group is playing those items. Other examples are also possible.

When playback zones or zone groups are "grouped" or "ungrouped," playback queues associated with the affected playback zones or zone groups may be cleared or re-associated. For example, if a first playback zone including a first playback queue is grouped with a second playback zone including a second playback queue, the established zone group may have an associated playback queue that is initially empty, that contains audio items from the first playback queue (such as if the second playback zone was added to the first playback zone), that contains audio items from the second playback queue (such as if the first playback zone was added to the second playback zone), or a combination of audio items from both the first and second playback queues. Subsequently, if the established zone group is ungrouped, the resulting first playback zone may be re-associated with the previous first playback queue, or be associated with a new playback queue that is empty or contains audio items from the playback queue associated with the established zone group before the established zone group was ungrouped. Similarly, the resulting second playback zone may be re-associated with the previous second playback queue, or be associated with a new playback queue that is empty, or contains audio items from the playback queue associated with the established zone group before the established zone group was ungrouped. Other examples are also possible.

Referring back to the user interface **400** of FIG. **4**, the graphical representations of audio content in the playback queue region **440** may include track titles, artist names, track lengths, and other relevant information associated with the audio content in the playback queue. In one example, graphical representations of audio content may be selectable to bring up additional selectable icons to manage and/or manipulate the playback queue and/or audio content represented in the playback queue. For instance, a represented audio content may be removed from the playback queue, moved to a different position within the playback queue, or

selected to be played immediately, or after any currently playing audio content, among other possibilities. A playback queue associated with a playback zone or zone group may be stored in a memory on one or more playback devices in the playback zone or zone group, on a playback device that is not in the playback zone or zone group, and/or some other designated device.

The audio content sources region **450** may include graphical representations of selectable audio content sources from which audio content may be retrieved and played by the selected playback zone or zone group. Discussions pertaining to audio content sources may be found in the following section.

d. Example Audio Content Sources

As indicated previously, one or more playback devices in a zone or zone group may be configured to retrieve for playback audio content (e.g. according to a corresponding URI or URL for the audio content) from a variety of available audio content sources. In one example, audio content may be retrieved by a playback device directly from a corresponding audio content source (e.g., a line-in connection). In another example, audio content may be provided to a playback device over a network via one or more other playback devices or network devices.

Example audio content sources may include a memory of one or more playback devices in a media playback system such as the media playback system **100** of FIG. **1**, local music libraries on one or more network devices (such as a control device, a network-enabled personal computer, or a networked-attached storage (NAS), for example), streaming audio services providing audio content via the Internet (e.g., the cloud), or audio sources connected to the media playback system via a line-in input connection on a playback device or network devise, among other possibilities.

In some embodiments, audio content sources may be regularly added or removed from a media playback system such as the media playback system **100** of FIG. **1**. In one example, an indexing of audio items may be performed whenever one or more audio content sources are added, removed or updated. Indexing of audio items may involve scanning for identifiable audio items in all folders/directory shared over a network accessible by playback devices in the media playback system, and generating or updating an audio content database containing metadata (e.g., title, artist, album, track length, among others) and other associated information, such as a URI or URL for each identifiable audio item found. Other examples for managing and maintaining audio content sources may also be possible.

The above discussions relating to playback devices, controller devices, playback zone configurations, and media content sources provide only some examples of operating environments within which functions and methods described below may be implemented. Other operating environments and configurations of media playback systems, playback devices, and network devices not explicitly described herein may also be applicable and suitable for implementation of the functions and methods.

III. Example Method for Adjusting Equalization Based on Environment

As discussed above, embodiments described herein may involve dynamically adjusting the equalization of a playback device based on the environment in which the playback device is operating.

Method **500** shown in FIG. **5** presents an embodiment of a method that can be implemented within an operating environment involving, for example, the media playback system **100** of FIG. **1**, one or more of the playback device **200** of FIG. **2**, and one or more of the control device **300** of FIG. **3**. Method **500** may include one or more operations, functions, or actions as illustrated by one or more of blocks **502-510**. Although the blocks are illustrated in sequential order, these blocks may also be performed in parallel, and/or in a different order than those described herein. Also, the various blocks may be combined into fewer blocks, divided into additional blocks, and/or removed based upon the desired implementation.

In addition, for the method **500** and other processes and methods disclosed herein, the flowchart shows functionality and operation of one possible implementation of present embodiments. In this regard, each block may represent a module, a segment, or a portion of program code, which includes one or more instructions executable by a processor for implementing specific logical functions or steps in the process. The program code may be stored on any type of computer readable medium, for example, such as a storage device including a disk or hard drive. The computer readable medium may include non-transitory computer readable medium, for example, such as computer-readable media that stores data for short periods of time like register memory, processor cache and Random Access Memory (RAM). The computer readable medium may also include non-transitory media, such as secondary or persistent long term storage, like read only memory (ROM), optical or magnetic disks, compact-disc read only memory (CD-ROM), for example. The computer readable media may also be any other volatile or non-volatile storage systems. The computer readable medium may be considered a computer readable storage medium, for example, or a tangible storage device. In addition, for the method **500** and other processes and methods disclosed herein, each block in FIG. **5** may represent circuitry that is wired to perform the specific logical functions in the process.

a. Emitting a First Audio Signal from a Playback Device.

At block **502**, the playback device emits a first audio signal from the playback device. For instance, playback device **200** of FIG. **2** may output the first audio signal from speaker(s) **212**.

The first audio signal may take a variety of different forms. For instance, the first audio signal may include a pulse. Such a pulse may be a recording of a brief audio pulse that approximates an audio impulse signal. Some examples include recordings of an electric spark, a starter pistol shot, or the bursting of a balloon. In some examples, the first audio signal may include a signal that varies over frequency, such as a logarithmic chirp, a sine sweep, a pink noise signal, or a maximum length sequence. Such signals may be chosen for relatively broader-range coverage of the frequency spectrum or for other reasons. The first audio signal may involve other types of audio signals as well.

The first audio signal may have a particular waveform. For instance, the waveform may correspond to any of these example audio signals described above, such as, an electric spark, a starter pistol shot, or the bursting of a balloon. Such a waveform may be represented digitally, such as in an array of data points (i.e. samples) representing the changes in sound pressure over time. The waveform of the first audio signal may be referred to as the first waveform.

The playback device may store the first audio signal as a recording. Then, when emitting the first audio signal, the playback device may playback the recording. The recording may take a variety of audio file formats, such as a waveform audio file format (WAV) or an MPEG-2 audio layer III (MP3), among other examples.

Alternatively, the playback device may dynamically generate the first audio signal. For instance, the playback device may generate a signal that varies over frequency according to a mathematical equation. Other examples are possible as well.

The playback device may emit the first audio signal at a particular sound pressure level (i.e. magnitude). The particular sound pressure level may reflect the peak magnitude of the first audio signal. For instance, the playback device may emit a pulse signal having a peak magnitude of 60 dB (with reference to 20 μPa). The sound pressure level may be configurable. For instance, user input to playback device **200** (or a controller thereof, such as network device **300**) may configure the sound pressure of the first audio signal at a particular sound pressure level. Alternatively, the sound pressure level may be pre-determined.

The playback device may emit the first audio signal in response to a trigger. Further, the trigger may cause the playback device to carry out additional functions of the present method. For instance, user input to playback device **200** (or a controller thereof, such as network device **300**) may trigger playback device **200** to carry out the present method to adjust the equalization of the playback device. As another example, movement of the playback device (i.e. a change of positioning or in location) may trigger the playback device **200** to carry out the present method. The playback device may detect such a movement via an accelerometer. Other types of triggers are possible as well.

As described above, the playback device may be arranged as part of a media playback system that may include a plurality of playback devices. Each playback device of the media playback system may emit a respective first audio signal. Further, each playback device may perform one or more of the functions described below. For instance, each playback device may emit a respective first audio signal, detect a respective second audio signal, determine one or more respective reflection characteristics, adjust an equalization setting, and cause an audio track to play.

In one instance, a media playback system may include a first playback device and a second playback device. The first playback device may emit the first audio signal and then detect the second audio signal (as discussed below). In addition, the second playback device may emit a third audio signal. The third audio signal may take a variety of forms, including, for instance, any of the example audio signals described above in relation to the first audio signal. In some embodiments, the second playback device may emit the third audio signal in response to receiving an instruction, from the first playback device, to emit the third audio signal. Alternatively, the second playback device may receive the instruction from a controller. Other examples are possible as well.

b. Detecting, by the Playback Device, a Second Audio Signal.

At block **504**, the playback device detects, by a microphone, a second audio signal. A portion of the second audio signal may be a reflection of the first audio signal. For instance, playback device **200** may emit the first audio signal, the first audio signal may reflect off of one or more objects (collectively these reflections may be referred to as reverberation), and microphone **220** may detect these reflections as the second audio signal. Another portion of the second audio signal may be a direct propagation of the first audio signal.

The microphone may be communicatively coupled to the processor. For instance, microphone **220** may be coupled to an analog input of processor **202** of playback device **200**. Alternatively, microphone **220** may be coupled to an analog-to-digital converter that is coupled, in turn, to processor **202**. Other arrangements are possible as well.

Detecting the second audio signal may involve recording the second audio signal. For instance, processor **202** may record the second audio signal and then store the second audio signal in memory **206**. Processor **202** may begin recording when the speaker emits the first audio signal. Alternatively, processor **202** may begin recording before or after the speaker emits the first audio signal such that reflections of the first audio signal may be detected by the microphone. The recording may be represented digitally, such as in an array of data points (i.e. samples) representing the changes in sound pressure over time. Further, the second audio signal may have a waveform that may be referred to as the second waveform.

In some circumstances, the second audio signal may include environmental noise. In some circumstances, significant environmental noise within the second audio signal may interfere with or otherwise affect determining the one or more reflection characteristics. For instance, environmental noise may mask or degrade the first audio signal, which may cause the playback device to determine one or more reflection characteristics that may not accurately reflect the environment because of the degradation caused by the environmental noise. Further, in some circumstances, an aspect of the environmental noise may be incorrectly detected as the first audio signal. While the second audio signal may include, as one portion, some background noise, the intention is that at least a portion of the second audio signal is the reflection of the first audio signal.

Accordingly, to reduce the possible effects of environmental noise, detecting the second audio signal may involve determining that the portion of the second audio signal is the reflection of the first audio signal based on the first waveform and the second waveform. For instance, the processor **202** may determine a difference between the first waveform and the second waveform by comparing the two waveforms. The playback device may then determine that the difference is less than a threshold which may indicate that the portion of the second audio signal is the reflection of the first audio signal. The threshold may be set such that a particular degree of similarity between the first waveform and the second waveform indicates that the portion of the second audio signal is a reflection of the first audio signal. Alternatively, several characteristics of the first waveform, such as the magnitude and duration, may be predetermined. The playback device may determine the same characteristics of the second waveform and compare the characteristics to determine that the portion of the second audio signal is the reflection of the first audio signal. As another example, the playback device may perform a deconvolution determination using the first audio signal and the second audio signal. Some embodiments may involve repeating the process described herein to reduce any effect caused by noise in a particular iteration.

The processor may determine the sound pressure level (i.e. magnitude) of the second audio signal. The sound pressure level of the second audio signal may be determined at each point along the waveform of the second audio signal or the sound pressure level may be determined at a subset of points, such as at the point having peak magnitude. For instance, the processor may determine that the second audio signal has a peak magnitude of 50 dB.

In some embodiments, the speaker and microphone may be physically coupled. For instance, a housing may contain both the speaker and the microphone. Further, the housing may additionally contain one or more other components of the playback device, such as a processor, a memory, a network interface, an audio amplifier(s), and/or various audio processing components. Therefore, in one embodiment, playback device **200** may include, within the same housing, processor

202, software components **204**, memory **206**, audio processing components **208**, audio amplifier(s) **210**, speaker(s) **212**, a network interface **214** including wireless interface(s) **216** and wired interface(s) **218** and a microphone **220**. The housing may be a speaker cabinet. Other arrangements are possible as well.

As noted above, in some embodiments, the playback device may be arranged as part of a media playback system that includes two or more playback devices. In such embodiments, the playback device may detect audio signals emitted by other playback devices (as an alternative to or in addition to detecting the second audio signal). Referring to the example media playback system above that includes the first playback device and the second playback device, after the second playback device emits a third audio signal, the first playback device may detect the third audio signal and/or reflections thereof as a fourth audio signal. In some embodiments, the first playback device may then determine that at least a portion of the fourth audio signal is the third audio signal (or a reflection thereof) using, for example, any of the techniques described above.

Detecting audio signals emitted by other playback devices may include functions similar to those of detecting the second audio signal. Further, devices within the media playback system may exchange messages to coordinate the functions described herein. For instance, as noted above, a first playback device may trigger a second playback device to emit a third audio signal. As another example, the second playback device may send an indication of the third audio signal to the first playback device. The indication may assist the first playback device in determining that a portion of the fourth audio signal is the third audio signal (or a reflection thereof), for example. Alternatively, receiving the indication may trigger the first playback device to start listening for an audio signal from the second playback device.

In some embodiments, the first media playback may detect a plurality of audio signals. For instance, the plurality of audio signals may include a reflection of a signal emitted by the first playback device. The plurality of audio signals may also include signals (or reflections thereof) emitted by other playback devices within the media playback system. Other examples are possible as well.

c. Determining One or More Reflection Characteristics.

At block **506**, the playback device determines one or more reflection characteristics. Each of the one or more reflection characteristics may indicate an aspect of the environment surrounding the playback device. For instance, one reflection characteristic may indicate that the playback device is inside, or that the playback device is outside. The reflection characteristic may also indicate a relative size of the room that the playback device is currently located within. Another reflection characteristic may indicate the amount of sound absorbing material in the environment. A third reflection characteristic may indicate one or more resonant frequencies of the environment. Many examples are possible.

In some embodiments, each of the one or more reflection characteristics may be based on at least the second audio signal. For instance, the processor **202** may determine one or more reflection characteristics based on the recording of the second audio signal. The one or more reflection characteristics may be further based on the first audio signal such as in a comparison of the second audio signal to the first audio signal.

One of the one or more reflection characteristics may be an amount of time elapsed from emitting the first audio signal to detecting the second audio signal. For instance, the processor **202** may assign to the first audio signal a first timestamp at the time of emitting the first audio signal and may further assign to the second audio signal a second time stamp at the time of detecting the second audio signal. The processor **202** may then determine a difference between the second time stamp and the first time stamp. Since each of the first audio signal and the second audio signal may be emitted and detected, respectively, over a duration of time, the time stamp may be assigned to a particular point in each of the first audio signal and the second audio signal. For instance, the time stamp may be assigned to the respective peaks of the first and second audio signals.

The reflection characteristic may be a qualitative characteristic. For instance, the qualitative characteristic may describe different types of operating environments, such as a "small room," a "large room," or "outdoors." The qualitative characteristic may be based upon a quantitative value, such as an amount of time elapsed from emitting the first signal to detecting the second audio signal. For example, the playback device may determine the qualitative characteristic (e.g. "small room," "large room," or "outdoors") based on a range of values for the amount of time elapsed from emitting the first signal. For example, an amount of time elapsed from emitting the first signal to detecting the second audio signal of 15-20 milliseconds (ms) may indicate a "small room," 20-30 ms may indicate a "large room," and an amount of time greater than 30 ms may indicate "outdoors."

The qualitative characteristics may describe additional features of the room. For instance, the qualitative characteristic may describe a number of objects within the room. Alternatively, the qualitative characteristic may further describe the shape of the room. For example, a qualitative characteristic may indicate "high ceilings" in a "small room" or that the room is relatively much longer than it is wide (i.e. the room is long and narrow).

One or more of the reflection characteristics may relate to a frequency response of a system that includes the playback device and the environment surrounding the playback device. Such a frequency response may be determined based on the emitted first audio signal and detected second audio signal. In particular, the first audio signal (i.e. the stimulus) may excite the system. The detected second audio signal then represents the response of the system in the time domain. The playback device may then determine the frequency response by transforming the time domain response to the frequency domain, such as by determining a Laplace transform on the second audio signal, or the portion thereof that is a reflection of the first audio signal. In some embodiments, determining the Laplace transform may involve determining, by the processor **202**, a fast Fourier transform (FFT), such as when the second audio signal is represented as discrete data points. While the FFT is provided by way of example, alternative transformations, such as a Hilbert transform, may be determined as well.

The determined frequency response of the system may indicate aspects of the environment. For instance, the processor **202** may determine that the bass frequencies within the frequency response are attenuated relative to the mid and/or treble frequencies, which may indicate that the playback device is outdoors. As another example, the processor **202** may determine that the frequency response has one or more resonant frequencies (which may be caused by the room or objects therein), which may be indicated by one or more peaks and/or one or more valleys. In addition, the number of peaks and valleys may indicate a degree of irregularity of the environment (i.e. a number of objects within the environment and/or an irregularity of the arrangement of the walls).

Within examples, one of the one or more reflection characteristics may relate to a variance between the frequency

response of the system and an "ideal" frequency response of the playback device. For instance, the reflection characteristic may be a difference between the "ideal" frequency response and the frequency response of the system. In some embodiments, the reflection characteristic may be a difference between the ideal frequency response and the current frequency response at a particular frequency range, such as bass, mid, or treble frequencies.

Determining the difference between the "ideal" frequency response and the current frequency response may involve, for each frequency response, integrating the respective frequency response over frequency for a portion of the frequency range. For instance, the processor **202** may integrate each frequency response over bass frequencies (e.g. 16 to 512 Hz). The processor **202** may then determine a difference between the integrated frequencies.

The "ideal" frequency response may be a frequency response of the playback device in a particular configuration. Further, the ideal frequency response may not be truly ideal, but rather an approximation of a playback device that is operating as designed. For instance, the "ideal" frequency response may be a frequency response of the playback device as determined in open space. Alternatively, the "ideal" frequency response may be a frequency response determined in an anechoic chamber. Further, the "ideal" frequency response of the playback device may be an approximation of a factory configured frequency response. For instance, the "ideal" frequency response may be a typical or average frequency response of playback devices of a particular type produced by a manufacturer.

In another embodiment, the playback device may determine the "ideal" frequency response as an aspect of a set-up procedure. For example, during the set-up procedure, a user of the playback device may be instructed to place the playback device in a particular arrangement so that the playback device may determine a frequency response. The particular arrangement may be, for instance, in the center of a room, among other examples.

FIG. **7** shows an illustrative plot of a frequency response of a playback device in a small room. Frequency response **702** shows the frequency response without an adjusted equalization setting. In a small room, the frequency response tends to have more peaks and valleys at bass frequencies, as shown, because bass frequencies may resonate more in a smaller room. Frequency response **704** shows the frequency response after an equalization setting for the small room has been applied. Compared to frequency response **702**, the peaks and valleys are attenuated in frequency response **704**, as shown.

One or more of the reflection characteristics may relate to an impulse response. For instance, an impulse response may indicate one or more reflections of the first audio signal. The impulse response may also indicate characteristics of the reflections, such as an amount of time elapsed between two reflections.

FIGS. **8**A-**8**C show example impulse responses of a playback device. FIG. **8**A shows an example impulse response of a playback device in (relatively) open space. After the initial excitation, the impulse response does not show a reflection, which may indicate that the playback device is outdoors, for example. FIG. **8**B shows another example impulse response of a playback device that is near a wall. As shown in FIG. **8**B, this impulse response includes a reflection of the impulse (near 8.6 ms), which may indicate the presence of a wall. FIG. **8**C shows yet another example impulse response of a playback device. As shown in FIG. **8**C, the impulse response includes two similar reflections of the impulse (near 8.6 ms and 12 ms). Such similarity may indicate that the two similar reflections are each off of the same wall.

As noted above, in some examples, the first media playback may detect a plurality of audio signals including audio signals emitted by the first media playback and/or audio signals emitted by other playback devices within the media playback system. In some embodiments, the playback device may determine one or more reflection characteristics for each of the detected audio signals (or a portion thereof). Alternatively, a reflection characteristic may be based on two or more audio signals in the plurality of detected audio signals. Other examples are possible as well.

Referring back to the example media playback system that include the first playback device and the second playback device, after detecting the fourth audio signal, the first playback device may then determine one or more reflection characteristics based on the fourth audio signal. Determining the one or more reflection characteristics based on the fourth audio signal may involve, for instance, any of the techniques described above for determining one or more reflection characteristics based on the second audio signal as discussed above.

While characteristics of detected audio signals have been referred to herein as reflection characteristics, in some embodiments, the audio signals may be detected before a reflection occurs. For instance, as noted above, an audio signal may propagate directly, such as from a first playback device to a second playback device.

d. Adjusting an Equalization Setting of the Playback Device Based on the One or More Reflection Characteristics.

At block **508**, the playback device adjusts an equalization setting of the playback device based on the one or more reflection characteristics. For instance, one or more of the audio processing components **208** may be configured to alter the frequency response of the playback device. Specifically, the one or more audio components **208** may include one or more filters. When audio content passes through the one or more filters, the amplitude of certain frequencies (or frequency ranges) may be increased. The amplitude of other frequencies (or frequency ranges) may be decreased. Alternatively, the processor **202** may be configured to alter the frequency response of the playback device. The processor **202** may, for example, apply digital signal processing, such as a digital filter, to audio content.

As noted above, one of the one or more reflections characteristics may indicate a frequency or frequency range. The playback device may adjust an equalization setting based on the frequency or frequency range. For instance, if the reflection characteristic indicates bass frequencies are attenuated, the equalization setting may boost bass frequencies (as noted above, 16-512 Hz). Alternatively, if a particular frequency, such as (2 kHz) is a peak or a valley, the equalization may responsively attenuate or boost that frequency.

Adjusting the equalization setting may involve disabling a speaker of the playback device. For instance, the processor **202** may disable the a speaker **212** when the one or more reflection characteristics indicate that the listening experience may be improved by disabling the speaker. For example, an object in close proximity to the front of the speaker may cause distortion, such as muffling, of audio outputted by the speaker. Due to the distortion, the listening experience may be improved by disabling the speaker. In such a circumstance, one or more particular reflection characteristics may indicate that the first audio signal reflected off a close object, such as an object within 10 centimeters of the playback device. Alternatively, the one or more particular reflection characteristics

may indicate that the frequency response of the playback device is distorted by the object.

Within examples, adjusting the equalization setting may involve selecting a particular equalization preset from a plurality of equalization presets based on at least one of the one or more reflection characteristics. Some of the equalization presets may be pre-determined. For example, each of the plurality of equalization presets may be a respective bass gain setting. For instance, a "small room" equalization preset may be pre-determined to attenuate bass frequencies. As another example, an "outdoors" equalization preset may be pre-determined to boost bass frequencies. The playback device may then adjust the equalization setting according to the selected particular equalization preset.

e. Causing an Audio Track to Play According to the Adjusted Equalization Setting.

In some embodiments, the playback device may perform block **510**. At block **510**, the playback device may cause an audio track to play according to the adjusted equalization setting. For instance, the playback device may provide the audio track to the audio processing components **208**, which may be adjusted based on the equalization setting. The audio processing components **208** may alter frequency components of the audio track according to the equalization setting. The audio amplifier **210** may then amplify the signal which may cause the speaker(s) **212** to emit the audio track.

f. Sending to a Second Media Playback Device an Indication of the Reflection Characteristic

In some embodiments, the playback device may perform block **512**. At block **512**, the playback device may send to a second media playback device an indication of the reflection characteristic.

Playback devices of the media playback system may share their one or more respective reflection characteristics with the other playback devices in the media playback system. In some configurations, a particular playback device may share its one or more reflection characteristics with all of the playback devices in the media playback system. In other configurations, the particular playback device may share with a subset of playback devices. For example, the particular playback device may be grouped into a zone with three other playback devices, and the particular playback device may share its one or more reflection characteristics with the three other playback devices in its zone.

For instance, referring to FIG. **1**, playback device **104** may send a particular reflection characteristic to playback devices **106**, **108**, and **110** that are grouped with playback device **104** into a zone. In turn, each of playback devices **106**, **108**, and **110** may receive the particular reflection characteristic. Playback devices **106**, **108**, and **110** may then send a respective particular reflection characteristic to playback device **104** and to each of the other playback devices in the zone. Each of the playback devices may send and/or receive reflection characteristics via a respective network interface, such as network interface **214** in FIG. **2**.

In some circumstances, the playback device may adjust the equalization setting based on determined reflection characteristics from other playback devices within the media playback system. For instance, a particular playback device may adjust its equalization setting based on reflection characteristics from other playback devices grouped with the particular playback device in a zone. Basing the equalization setting on reflection characteristics from other playback devices may result in an equalization setting that is more appropriate for the environment.

For example, FIG. **6** shows an example configuration of a media playback system **100** that includes playback devices **602** and **604** that are grouped into a zone. Playback devices **602** and **604** may each emit a respective first audio signal, detect a respective second audio signal, and then determine a respective reflection characteristic that indicates the size of the room. Further, playback devices **602** and **604** may exchange respective reflection characteristics by sending and receiving the reflection characteristics over respective network interfaces.

The reflection characteristic determined by playback device **602** may indicate a smaller room than the reflection characteristic determined by playback device **604** because of the relative difference in how far the each emitted first audio signal travels before coming into contact with a respective wall that reflects the first audio signal, as shown. If playback devices **602** and **604** each base their respective equalization setting on their own respective reflection characteristic, then playback device **602** may adjust the equalization to a setting that is appropriate for a small room, while playback device **604** may adjust the equalization to a setting that is appropriate for a large room. In some circumstances, this difference in relative configurations may result in a mismatch in the frequency responses between playback device **602** and **604**, which may worsen the listening experience for some users (yet, in other circumstances, this difference may be minor and may not have a significant impact on the listening experiences of users). However, as noted above, playback devices **602** and **604** may adjust the equalization setting based on determined reflection characteristics from one another. For instance, playback devices **602** and **604** may each average their determined reflection characteristic with the determined reflection characteristic of the other playback device. In this manner, the resulting adjusted equalization setting for each of playback devices **602** and **604** may be somewhere between that of a large room and a small room.

Within examples, each playback device of a media playback system may share its adjusted equalization setting with the other playback devices in the media playback system, such as by sending the adjusted equalization setting to other playback devices in the media playback system. In turn, one or more of the other playback devices may adjust their equalization setting based on the received equalization settings.

For instance, a first playback device and a second playback device that are grouped into a zone may each send to one another their respective adjusted equalization setting. Then, each of the first and second playback devices may adjust their respective equalization setting based on the received equalization setting. For example, the first playback device may determine that a particular one of the two adjusted equalization settings from either the first playback device or the second playback device is preferable for the environment. The first playback device may then (i) adjust its equalization setting based on the particular one of the two adjusted equalization settings and/or (ii) instruct the second playback device to adjust its equalization setting based on the particular one of the two adjusted equalization settings.

IV. Conclusion

The description above discloses, among other things, various example systems, methods, apparatus, and articles of manufacture including, among other components, firmware and/or software executed on hardware. It is understood that such examples are merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all of the firmware, hardware, and/or software aspects or components can be embodied exclusively in hardware, exclusively in software, exclusively in firmware, or in any combi-

nation of hardware, software, and/or firmware. Accordingly, the examples provided are not the only way(s) to implement such systems, methods, apparatus, and/or articles of manufacture.

As indicated above, the present application involves dynamically adjusting the equalization of a playback device based on the environment in which the playback device is operating. In one aspect, a method is provided. The method involves emitting, by a playback device, a first audio signal, detecting, by the playback device, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal, in response to the detecting, determining one or more reflection characteristics, wherein each of the one or more reflection characteristics are based on at least the second audio signal, adjusting an equalization setting of the playback device based on the one or more reflection characteristics; and causing an audio track to play according to the adjusted equalization setting.

In another aspect, a second method is provided. The second method is operable in a media playback system comprising a plurality of playback devices, wherein each playback device comprises a respective microphone and a respective speaker. The second method involves receiving an indication of a first audio signal, detecting, by a microphone of the first playback device, a second audio signal, wherein at least a portion of the second audio signal is indicative of the first audio signal, in response to the detecting, determining a first reflection characteristic based on the second audio signal, adjusting an equalization setting of the first playback device based on at least the first reflection characteristic, and sending to a second media playback device an indication of the first reflection characteristic.

In another aspect, a device is provided. The device includes a speaker, a microphone that is physically coupled to the speaker, a processor, a network interface, a data storage, and a program logic stored in the data storage. The program logic is executable by the processor to emit a first audio signal from the speaker, detect, via the microphone, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal, in response to the detecting, determine a first reflection characteristic based on at least the second audio signal, adjust an equalization setting of the playback device based on at least the first reflection characteristic, and play, via the speaker, an audio track according to the equalization setting.

In yet another aspect, a non-transitory computer readable memory is provided. The non-transitory computer readable memory has stored thereon instructions executable by a computing device to cause the computing device to perform functions. The functions include emitting, by a playback device, a first audio signal, detecting, by the playback device, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal, in response to the detecting, determining one or more reflection characteristics, wherein each of the one or more reflection characteristics are based on at least the second audio signal, adjusting an equalization setting of the playback device based on the one or more reflection characteristics; and causing an audio track to play according to the adjusted equalization setting.

Additionally, references herein to "embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment can be included in at least one example embodiment of an invention. The appearances of this phrase in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. As such, the embodiments described herein, explicitly and implicitly understood by one skilled in the art, can be combined with other embodiments.

The specification is presented largely in terms of illustrative environments, systems, procedures, steps, logic blocks, processing, and other symbolic representations that directly or indirectly resemble the operations of data processing devices coupled to networks. These process descriptions and representations are typically used by those skilled in the art to most effectively convey the substance of their work to others skilled in the art. Numerous specific details are set forth to provide a thorough understanding of the present disclosure. However, it is understood to those skilled in the art that certain embodiments of the present disclosure can be practiced without certain, specific details. In other instances, well known methods, procedures, components, and circuitry have not been described in detail to avoid unnecessarily obscuring aspects of the embodiments. Accordingly, the scope of the present disclosure is defined by the appended claims rather than the forgoing description of embodiments.

When any of the appended claims are read to cover a purely software and/or firmware implementation, at least one of the elements in at least one example is hereby expressly defined to include a tangible, non-transitory medium such as a memory, DVD, CD, Blu-ray, and so on, storing the software and/or firmware.

I claim:

1. A method comprising:

emitting, by a playback device, a first audio signal;

detecting, by the playback device, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal;

in response to the detecting, determining one or more reflection characteristics, wherein each of the one or more reflection characteristics are based on at least the second audio signal;

adjusting an equalization setting of the playback device based on the one or more reflection characteristics; and

causing an audio track to play according to the adjusted equalization setting.

2. The method of claim **1**, wherein the playback device comprises a microphone and a speaker, and wherein the microphone is physically coupled to the speaker.

3. The method of claim **1**, wherein the first audio signal has a first waveform, wherein the second audio signal has a second waveform, and wherein detecting the second audio signal comprises:

determining, based on the first waveform and the second waveform, that the portion of the second audio signal is the reflection of the first audio signal.

4. The method of claim **1**, wherein adjusting the equalization setting of the playback device based on the one or more reflection characteristics comprises

disabling a speaker of the playback device.

5. The method of claim **1**, wherein at least one of the one or more reflection characteristics comprises an amount of time elapsed from emitting the first audio signal and detecting the second audio signal.

6. The method of claim **1**, wherein the first audio signal is emitted at a first sound pressure level, wherein the second audio signal is detected at a second sound pressure level, and wherein at least one of the one or more reflection characteristics comprises a difference between the first sound pressure level and the second sound pressure level.

7. The method of claim **1**, wherein adjusting an equalization setting of the playback device based on the one or more reflection characteristics comprises:

selecting a particular equalization preset from a plurality of equalization presets based on at least one of the one or more reflection characteristics; and

adjusting the equalization setting of the playback device according to the selected particular equalization preset.

8. The method of claim **7**, wherein each of the plurality of equalization presets comprises a respective bass gain setting.

9. The method of claim **7**, wherein at least one of the one or more reflection characteristics comprises an amount of time elapsed since emitting the first audio signal until detecting the second audio signal, wherein each of the plurality of equalization presets is matched to a respective time range, and wherein selecting one from a plurality of equalization presets based on the at least one reflection characteristic comprises:

determining a particular time range that corresponds to the amount of time; and

selecting the equalization preset matched to the determined particular time range.

10. The method of claim **1**, wherein the first audio signal is an impulse signal.

11. In a media playback system comprising a plurality of playback devices, wherein each playback device comprises a respective microphone and a respective speaker, a method comprising:

receiving an indication of a first audio signal;

detecting, by a microphone of the first playback device, a second audio signal, wherein at least a portion of the second audio signal is indicative of the first audio signal;

in response to the detecting, determining a first reflection characteristic based on the second audio signal;

adjusting an equalization setting of the first playback device based on at least the first reflection characteristic; and

sending to a second playback device an indication of the first reflection characteristic.

12. The method of claim **11**, wherein adjusting the equalization setting is further based on at least a second reflection characteristic, the method further comprising:

receiving, via a network interface of the playback device, an indication of the second reflection characteristic from the second playback device.

13. The method of claim **11**, wherein the equalization setting is further based on at least a second reflection characteristic, the method further comprising:

detecting, via a microphone of the first playback device, a fourth audio signal, wherein at least a portion of the fourth audio signal is a reflection of a third audio signal emitted by the second playback device; and

determining the second reflection characteristic based on the fourth audio signal.

14. The method of claim **11**, further comprising:

sending an indication of the adjusted equalization setting to the second media playback device.

15. A playback device, comprising:

a speaker;

a microphone that is physically coupled to the speaker;

a processor;

a network interface;

a data storage; and

a program logic stored in the data storage and executable by the processor to:

emit a first audio signal from the speaker;

detect, via the microphone, a second audio signal, wherein at least a portion of the second audio signal is a reflection of the first audio signal;

in response to the detecting, determine a first reflection characteristic based on at least the second audio signal;

adjust an equalization setting of the playback device based on at least the first reflection characteristic; and

play, via the speaker, an audio track according to the equalization setting.

16. The playback device of claim **15**, wherein the equalization setting is further based on at least a second reflection characteristic, and wherein the program logic is further executable by the processor to:

receive, via the network interface, an indication of the second reflection characteristic from a second playback device.

17. The playback device of claim **15**, wherein the equalization setting is further based on at least a second reflection characteristic, and wherein the program logic is further executable by the processor to:

detect, by the microphone, a fourth audio signal, wherein at least a portion of the fourth audio signal is indicative of a reflection of a third audio signal emitted by a second playback device; and

determine the second reflection characteristic based on the fourth audio signal.

18. The playback device of claim **15**, wherein detecting the second audio signal comprises:

determining that the portion of the second audio signal is a reflection of the first audio signal.

19. The playback device of claim **15**, wherein the first reflection characteristic comprises an amount of time elapsed from emitting the first audio signal to detecting the second audio signal.

20. The playback device of claim **15**, wherein adjusting an equalization setting of the playback device based on at least the first reflection characteristic comprises:

selecting a particular equalization preset from a plurality of equalization presets based on the first reflection characteristic; and

adjusting the equalization setting of the playback device according to the selected particular equalization preset.

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